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THE SIPHONOPHORES.

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(*Continued from October number, 1881.*)

IV.—ANATOMY AND DEVELOPMENT OF DIPHYES.

THE Siphonophores which we have thus far considered all agree in this particular, that they have a float attached at one end of the stem to buoy it up in the water. It may, in some genera, be doubtful how far this structure is necessary, or to what extent it is functional, but it is never without representation in any of the Physophoridæ. We come now to consider tubular jelly-fishes, which may be looked upon as in many respects the highest[1] of the Siphonophores. In no member of the group is there a float such as is to be found in Agalma and its allies, while in details of structure their organization is very characteristic, and different from the tubular Medusæ already studied. A good representative of these Medusæ, whose several genera make up the Diphyidæ,[2] is the beautiful genus Diphyes, represented in our waters, as far as explored, by a single species. An account of the anatomy and development of this genus seems a fitting introduction to a more extended acquaintance with the remaining Siphonophores, which embrace some of the most beautiful animals with which the student of marine life is familiar.

The differences between Diphyes and Agalma seem so great

[1] If we consider, however, their anatomy, and the likeness of some of the Diphyidæ to the primitive medusa of Agalma, we may place them, as a whole, below the Physophoridæ. My reasons for placing them higher will be given later in this paper.

[2] The designation Diphyidæ seems to me preferable to Leuckart's term, Calycophoridæ. The very aberrant genus Hippopodius is the type of a family between the Physophoridæ and Diphyidæ.

that, at first sight, it is almost impossible to recognize anything in common between them both. A more intimate study, however,

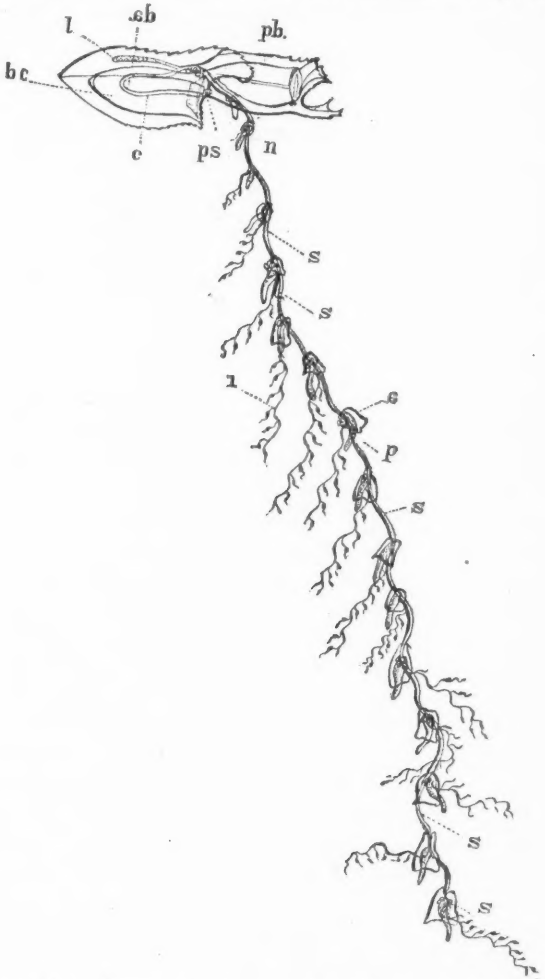

FIG. 1.—*Diphyes formosa*, sp. nov. *a*, covering scale; *ab*, anterior bell; *bc*, bell cavity; *pb*, posterior bell; *ps*, pigment spot (ocellus?); *c*, long tube of anterior bell; *l*, somatocyst; *n*, ridges on lower side of posterior bell; *s*, stem; *a* covering-scale; *p*, polypite; *i*, tentacle.

brings out very many resemblances which a casual observation had overlooked.

Prominent among all the structures which characterize the Siphonophores, is the axis or stem from which the group is named. In Diphyes this part *(s)* is very well developed, and in live specimens may be seen trailing behind to a great distance in the water, just as we have seen was the case in the genera of Physophoridæ already mentioned. Along its whole extent we find appendages so fastened that they do not incommode in the least possible manner the direct motion of the animal through the water. In the genus Diphyes it will be noticed that all the organs are especially adapted for rapid motion, and as one watches these graceful tubes, with their appendages, shooting through the sea, the adaptation for this mode of life seems complete. With this thought in mind, one can almost predict the organs of the Physophores which should be missed in Diphyes, and the modifications of their form which would be expected.

A float would, if of any size, be a great impediment to the free motion of the jelly-fish. In Diphyes, consequently, it is altogether wanting, and other methods are resorted to in order to diminish the specific gravity of the colony.

No organ of Diphyes better illustrates the modification and adaptation which has taken place to bring about rapid motion, than those which move the colony, which are here, as in all Siphonophores, the nectocalyces. There are only two of these swimming-bells, as they are called, and they are very different in outline and general appearance from the swimming-bells of any of the animals which we have yet considered. These bells differ also one from the other, in size, shape and anatomy.

At one end of the axis of Diphyes, as it floats gracefully extended in the water, there are two gelatinous, transparent bodies of somewhat conical shape *(ab, pb)*; these are the two nectocalyces which, with the exception of one genus, Hippopodius, are double throughout all the members of the Diphyidæ.[1] The connection between the two bells at the extremity of the axis is so strong, that when they are raised from the water they are not broken apart, but the axis, by contraction, is simply drawn up into a deep groove in the under side of the bell, while the appendages, even when the colony is lifted out of water, remain attached

[1] In the genus Monophyes there is but a single nectocalyx. This genus is, in this respect as well as in other details of structure, very peculiar. I shall speak of it more at length in considering the different genera of Diphyidæ. Hippopodius has many nectocalyces.

much more strongly than corresponding structures of Agalma and kindred forms. In this retracted position they are often carried, as the animal darts forward in its course through the water. To facilitate that motion by diminishing the resistance of the surrounding medium, the method of attachment no less than the form of the bells, contributes.

In Agalma the nectocalyces, as we have seen, seem to arise in two rows, with bell openings looking in opposite directions. They are capable of a very limited change of position, and most of the variety of motion which the colony has, is brought about by combination in the action of nectocalyces situated in different regions of the stem, or in a muscular twisting of the axis upon which they are fastened, by which their openings are made to face in different directions. The method is too simple if rapid motion be desired, and ill adapted to that purpose in Diphyes. In Stephanomia variety and rapidity of movement are brought about by multiplication of nectocalyces. Even in this genus the means are inferior to those which we find in Diphyes.[1]

The swimming-bells of Diphyes are placed one behind the other, so that their longer axes lie in a straight line which falls in the direction of motion. Both bell cavities open in the same way, facing backward as they float in the water. When they act simultaneously the fluid ejected from their cavities by the contraction of the bell walls, presses together on the surrounding medium and reinforces each other. There is no action of one bell in opposition to another, as may happen in Agalma. The volume of ejected water is comparatively much larger than in any of the Physophoridæ.

The anterior bell *(ab)* of the two nectocalyces has a pyramidal shape, and is pointed at the apex opposite the bell opening. If this bell were attached by the same region as the nectocalyx of Agalma, it would seem as if this apical prolongation should also indicate the place of attachment of the stem. In Diphyes, however, this is not the case. The apex of the first bell is not homologous to the apex of the bell of other Medusæ, nor does it correspond to the point of attachment of the nectocalyx to the stem

[1] The motion of the Diphyes is sometimes so rapid that the eye cannot follow the animal. The water is driven out of the bell cavity by a single muscular contraction of the bell walls and when the impetus is lost a new contraction follows. The movement of the two nectocalyces is simultaneous.

of Agalma. The apex of the anterior bell is in reality the prolongation of the side of the bell, while the true apex has been abnormally twisted out of position, and is found just above the bell opening, near the origin of the stem which seems to hang down between the two nectocalyces.

Nowhere in its structure is the modification, which takes place in the organs of the bell as a result of this abnormal twisting, better shown than in the course of the chymiferous tubes upon the inner walls of the bell cavity. The radial tubes are especially modified in their course by the change in external form which the bell has undergone.

The chymiferous tubes of the anterior nectocalyx in Diphyes, consist of a system of four radial vessels placed upon the inner walls of the bell cavity, and a single large tube or cavity extending into one side of the bell walls parallel to the outer surface. The former tubes start from a common junction, and pass radially to the bell margin, while the latter ends blindly about two-thirds the distance between the bell rim and the pointed extremity of the nectocalyx. Both open into the cavity of the stem; the former by a vessel passing from their junction to the stem; the latter more directly through the same tube.

The length of the four radial tubes is very unequal, as would naturally be expected if the distortion which we have suggested as having taken place in the anterior bell, has in reality occurred. The two tubes *(c)* which lie in those parts of the bell which have been enlarged, are therefore naturally much longer than those in the remaining portions of the bell. So small indeed has that side of the nectocalyx which adjoins the posterior bell become, and so enormously has the opposite half been enlarged, that the tubes of one are inconspicuous and with difficulty traced, while those of the other are very prominent on the inner bell walls. At first sight then, we might suppose that there were but two radial vessels, while a closer study shows that there are four such tubes as we have seen exists in the nectocalyces of all Siphonophores. At the common junction of these tubes, we must look for the apex of the bell cavity. At that point, about midway in the length of the two bells, the vessels communicate with the stem cavity by means of a short tube, similarly placed to a like vessel in the nectocalyx of Agalma.

There is, however, in the anterior nectocalyx a tube *(l)* which

has the form of a cavity filled with a spongy mass[1] of cells, and which seems without representation in the bell of Agalma. This cavity starts from the union of the vessel last mentioned with the stem cavity, and extends through the substance of the bell walls, ending blindly a short distance from its union with the stem. If we look for its homologue in the bells of Agalma, it will be found to exactly correspond in position with the mantel tubes, which are diminutive branches from the vessel which in Agalma connects the radial system with the cavity of the axis. This greatly developed mantel tube in the anterior nectocalyx of Diphyes has been called the somatocyst. It is not a float, as far as its homology goes, although it may, at times, contain globules of oil, which serve to diminish the specific gravity of the animal. The existence of the somatocyst in the bell walls on one side, and not on the other, necessitates a thickening of those lateral walls, which are usually placed uppermost as the medusa floats in the water. The walls on the opposite or lower side are very thin. The thickened upper bell walls, from which the axis hangs, are continued beyond the margin of the bell in order to give a basis of attachment to the stem. This elongation extends over and protects[2] a portion of the posterior nectocalyx, as shown in the figure. It often happens that the posterior bell is ruptured from its connection with the anterior, and but one nectocalyx, with its attached stem, is found. Such a find is liable to deceive a novice in the study of the tubular medusa. It can be laid down as a law to which there is but one exception as yet known, that all the adult Diphyidæ have two nectocalyces in their normal condition.

The second or posterior nectocalyx *(pb)* differs widely from the anterior in shape and in the character of its chymiferous vessels, more particularly in their course through the bell walls. While it has the elongated form of the anterior, the course of the

[1] The appearance of a "spongy mass," which seems to fill the somatocyst of Diphyes, is due to an enlargement of the walls so that the cells seem to fill the whole cavity. *D. turgida*, described by Gegenbaur, has no somatocyst. (Gegenbaur, Zeit. f. Wiss. Zool., v, 1854, p. 442–448, Taf. 23. Keferstein and Ehlers, Zoologische Beiträge, p. 16.

[2] It is to be noticed that the projection of the prolongation of the anterior nectocalyx over the posterior, strengthens the union of these two structures. A firm union is necessary in order that in their simultaneous action no movement of one bell on the other should take place. If such a motion occurs a part of the forward impetus would be lost. Rigidity of the nectocalyces is here very necessary, and hence the close soldering together of these parts.

radial tubes as well as the point of attachment of the bell to the stem, shows that one side of the bell is not abnormally developed at the expense of the other. Its general form is exactly what would take place if an Agalma bell were much elongated in the line of its height, in order to secure a greater capacity for the cavity.

The most important variation in shape from the anterior bell, is the formation of two ridges extending the whole length of the under side of the posterior nectocalyx on the side which is opposite that part of the anterior bell which is thickened and bears the somatocyst. These ridges are continued into two prominences beyond the bell opening.[1] In the interval between these two ridges there is a groove in which is lodged the stem when retracted. In some genera, as Abyla, still further means of covering the stem when thus retracted are found, but in Diphyes the groove is without covering. The posterior bell is smaller than the anterior, and is easily detached. Its radial system of vessels communicates with the stem cavity by a small vessel which is destitute of mantel tubes or somatocyst. While the two nectocalyces of Diphyes are the most prominent structures in the animal when alive, and the only organs to be studied in alcoholic specimens, they are by no means the most important. The active habits of Diphyes has given them this predominance in size. There remain many other appendages to the stem yet to be mentioned.

These parts of the colony are fastened regularly along the whole length of the stem to its very extremity. They consist of covering-scales, polypites to which are appended tentacles dotted along their length with tentacular pendants, and clusters of sexual bells. Representatives of the bodies called tasters in my account of Agalma do not exist, as far as known, in the Diphyidæ. The appendages are not placed irregularly upon the stem, a polypite in one place and a cluster of sexual bells in another, but are found in clusters, separated by short intervals of the stem. Each cluster consists of a covering-scale, a polypite with its ten-

[1] The projections formed by the continuation of the ridges on the under side of the posterior nectocalyx probably act as rudders to determine the direction which the animal takes as it moves, or to regulate the angle at which the water leaves the bell cavity. In some genera of Diphyidæ, similar structures undoubtedly have this function, and it seems highly probable that the same is true in the projections under the opening of the posterior bell in Diphyes.

tacle and a cluster of sexual bells. In Apolemia we find a like clustering of homologous parts, and the same law goes through all the Diphyidæ with the exception of the single genus Hippopodius.

The clusters which were described in the genus Apolemia, separate from the remainder of the colony and lead an independent life. This is also true in a more complete form in the clusters of the Diphyes colony. For a long time these separated fragments were thought to be new genera, that from a Diphyes had been called Eudoxia, until it was shown by Leuckart that it was in reality only a fragment dropped from the stem of a Diphyes.

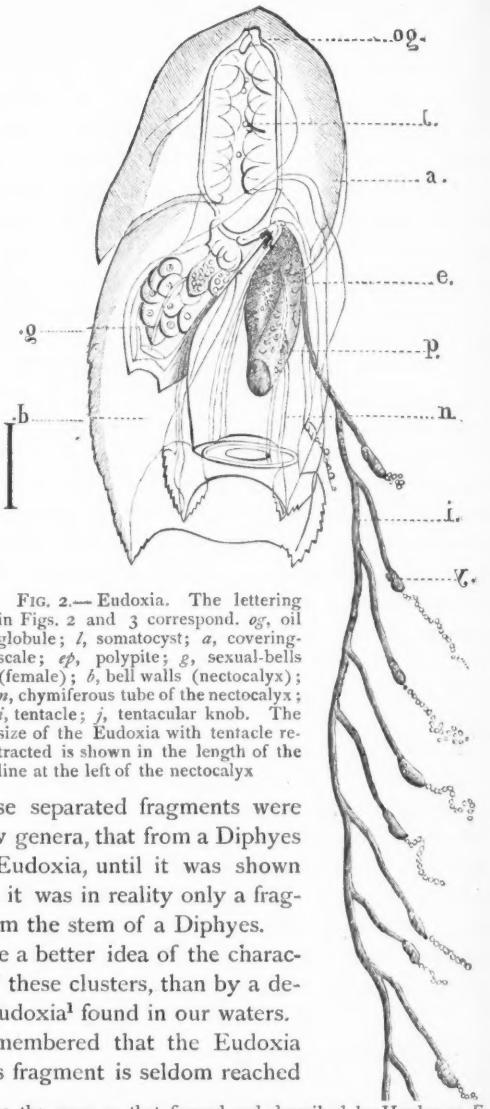

FIG. 2.— Eudoxia. The lettering in Figs. 2 and 3 correspond. *og*, oil globule; *l*, somatocyst; *a*, covering-scale; *ep*, polypite; *g*, sexual-bells (female); *b*, bell walls (nectocalyx); *n*, chymiferous tube of the nectocalyx; *i*, tentacle; *j*, tentacular knob. The size of the Eudoxia with tentacle retracted is shown in the length of the line at the left of the nectocalyx

We cannot give a better idea of the characteristics of one of these clusters, than by a description of the Eudoxia[1] found in our waters.

It must be remembered that the Eudoxia form of a Diphyes fragment is seldom reached

[1] This Eudoxia seems the same as that figured and described by Huxley as *E. Lessonii*. It is here supposed that this Eudoxia is the diphyizoid of *Diphyes acuminata*. The form of the appendages extending backward on the lower surface of the posterior nectocalyx are so different in shape in this species and *D. acuminata*, that the species here figured may be as yet undescribed.

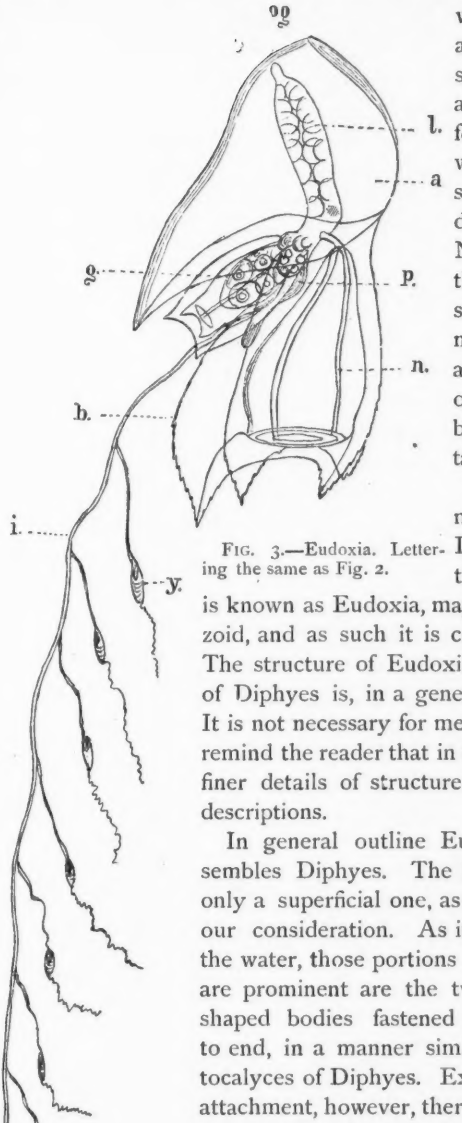

FIG. 3.—Eudoxia. Lettering the same as Fig. 2.

while attached to the axis. It is only after separation that the appendages grow to a form like that which we are about to describe. The Eudoxia discovered by us at Newport, R. I., although probably the same species as that mentioned by Huxley and others, was found one or two seasons before its Diphyes was taken.

A separated fragment of one of the Diphyidæ, which in the case of Diphyes is known as Eudoxia, may be called a Diphyizoid, and as such it is commonly described. The structure of Eudoxia, or the Diphyizoid of Diphyes is, in a general way, as follows. It is not necessary for me again to more than remind the reader that in these popular papers finer details of structure are omitted in my descriptions.

In general outline Eudoxia (Fig. 2) resembles Diphyes. The likeness, however, is only a superficial one, as will be seen later in our consideration. As it floats or swims in the water, those portions of the colony which are prominent are the two gelatinous bell-shaped bodies fastened to each other, end to end, in a manner similar to the two nectocalyces of Diphyes. Except in the mode of attachment, however, there is little likeness between them, either morphologically or functionally. Of the two transparent campanulate bodies, the anterior *(a)* is not, in Eudoxia, a nectocalyx, but a thickened, almost con-

ical covering-scale; its surface is convex with one side flattened and the base concave for the lodgment of the sexual bells and retracted tentacle. There are no radial vessels in this covering-scale, and only the central cavity *(l)* of peculiar cellular appearance, representing the somatocyst. At the fundus of this cavity there is generally found an oil globule *(og)* which it is unnecessary to say has no morphological relationships with the float of Agalma and its allies. A similar globule is also found at the base of the somatocyst near the point of attachment of the young Eudoxia to the stem of the Diphyes, before the rupture of the fragment took place.

The structure of the covering-scale of Eudoxia betrays at once the homology of the central tube of the covering-scales of other Siphonophores, as well as of the somatocyst of the anterior bell of Diphyes. The covering-scale of Eudoxia resembles the anterior bell of Diphyes except that it has no radial system of vessels and no bell cavity. The somatocyst of the swimming-bell of the Diphyes is represented in its fragment, Eudoxia, by the central cavity *(l)* of the large covering-scale. This cavity is in turn the same as the central tube of the covering-scales of all other Siphonophores. When we recollect what has been pointed out above in relation to the homology of the somatocyst to the mantle vessels in the nectocalyces of Agalma, the true homology of the covering scale and the nectocalyx becomes evident. If this view of the morphology be a correct one, the comparison of the covering-scale with the asymmetrical bell of a hydroid like the genus Hybocodon, is not correct, or at least its medially-placed tube does not correspond with a radial tube in the bell walls of the hydroid medusa.

The under side or base of the conical covering-scale of Eudoxia is very concave, and in this recess hang, when retracted, the remaining structures of the animal. The largest *(b)* of these bodies is a nectocalyx whose outer walls are crossed by four longitudinal ridges, serrated on their edges and continued into projections beyond the bell cavity. Two of these ridges, corresponding with those found on the under side of the posterior nectocalyx of Diphyes, are more prominent than the other pair, and enclose a canal in which the polypite, tentacle and sexual bell, lie when retracted. The bell cavity is deep, filling almost the whole interior of the nectocalyx, and along its surface pass

the four radial tubes *(n)* from common junction at the apex of the cavity to the bell rim. Their length is about equal, and their course in the bell walls is direct, without division or bifurcation. In the interval between the point of union of the covering-scale and nectocalyx, suspended from the under side of the former, hangs a flask-shaped body *(p)* which resembles very closely the feeding polyps of Agalma. It contains the stomach, and at its free end is found the mouth. The stomach cavity is in direct communication with the cavity of the covering-scale. From a point near the origin of the polypite there is suspended a long flexible highly contractile tentacle. This tentacle can be wholly retracted at the base of the polypite, but when the Eudoxia is in motion, is found reaching far behind the point of suspension, gracefully extending to a great length. In addition to the polypite we also find a cluster of bells *(g)* occupying the interval below the covering-scale and its point of attachment to the nectocalyx already mentioned. These bells enclose in their cavities, in place of a proboscis, a globular mass of eggs. It will be seen that the Eudoxia, which I have described, has female[1] sexual bells only; the male bells I have never been fortunate enough to find. The sexual bells are found in all stages of growth, from a simple bud to a well developed bell hanging from a stout peduncle. The history of the growth of the egg after it is dropped from the female bell, will be treated of in a special paper on the embryology of Diphyes.

The anatomy of Diphyes seems to me to sustain the homology of the Siphonophores as pointed out in our account of the anatomy of Agalma. The absence of the float at the extremity of the stem offers no difficulty to this homology when we recollect that the air bladder itself is only a modified medusa bell, and consequently homologous to the anterior of the two bells of Diphyes. The posterior nectocalyx is homologous to a true nectocalyx, while the anterior represents the float of the Physophoridæ. The axis of Diphyes, as that of Agalma, is homologous with the proboscis of a Lizzia, and from its sides bud the medusoid individuals. There is this very important difference between

[1] According to Gegenbaur, Keferstein and Ehlers, male and female sexual organs coexist on the same Diphyes stem. In the Diphyes which I have studied, that is not the case. The male sexual bell of the American form is unknown to me. Leuckart has also long ago (1853–4) shown that the European Diphyidæ are diœcious (Siphonophoren von Nizza, p. 28. Zoologische Untersuchungen, p. 36).

the proboscis of Lizzia and the stem of Diphyes, that while the buds from the former separate without absorption of the stomach walls, the Eudoxia appropriates a section of the Diphyes axis to form essential parts of its body.

To my mind there is no difficulty in a comparison of the Eudoxia with Lizzia[1] and with the Physophoridæ. Eudoxia is the adult form of which the Diphyes is the "nurse stage," so that we have here a true alternation of generation as in other medusæ. It is natural, therefore, that the likeness between Eudoxia and Agalma should be a distant one, since the latter genus never passes out of the Diphyes form, or the "nurse" from which the Eudoxia buds. On this account I consider the Physophoridæ as lower, anatomically and embryologically, than the Diphyidæ. Like those forms of fixed hydroids, which never drop medusa-shaped buds, and never, therefore, advance out of the fixed "nurse stage," the Physophoridæ never attain as completely developed a form as the Diphyidæ. They never bud off a gonophore as the medusoid bud is sometimes called, but always remain in the embryonic form. As the Diphyes stage is comparable with a strobila or a budding Lizzia, the Eudoxia is the completed generation comparable with the adult Lizzia which drops the eggs, or the sexual form.

The following table exhibits the corresponding parts of Lizzia and Eudoxia:

Lizzia.	Eudoxia.
Bell.	Covering scale (*a*).
Manubrium (proboscis).	Feeding polyp (polypite) (*p*).
Tentacle of a bud from the proboscis, the bell of which is aborted.	Tentacle (*t*).
Modified medusa bud from the proboscis, the proboscis and tentacle of which are lost (aborted).	Swimming-bell (*b*).
Several buds from the proboscis (young Lizziæ).	Sexual-bells (*g*).

[1] The comparison of Eudoxia to a "budding Lizzia" was set first forth, substantially as given in this article, by Professor McCrady in 1857 (Gymophthalmata of Charleston Harbor, p. 67). Since that date the theory has been urged on embryological grounds, without a mention of McCrady's suggestion, by Haeckel, Metschnikoff and P. E. Müller. (Haeckel. Zur Entwick. der Siphonophoren, 1869. Metschnikoff, Stud. uber Entwick. d. Medusen u. s.w., Zeit. f. Wiss. Zool., Bd. XXIV. P. E. Müller, Iag. over Nogle Siphonophorer, Nat. Tidsskrift 3. R. 7. B. Resumé in French). I am indebted to my friend, the late Mr. G. Winther, for a written MS. translation of portions of Müller's work.

If we were to follow precedent in our studies of the Siphonophores, we must apply to the adult the name Eudoxia instead of the almost universally used Diphyes. It is just as absurd to retain the name Diphyes to designate anything but a younger stage in the growth of Eudoxia, as it would be to designate the adult sea-urchin a pluteus, or to retain the word auricularia for the adult starfish. The monogastric form, or the Eudoxia, is the adult; the polygastric, or Diphyes, the larva.

There is another point to be considered. If from the embryonic feature of possessing a long axis, or stem, the relatives of Diphyes are referred to the Siphonophores, is that reference a good one, and would the characters as assigned to the group to which Agalma belongs (Siphonophoræ) hold in descriptions of the adult Diphyid? The Eudoxia has no stem-like structure, which gave the name to the group, although it is a true relative.

The comparison of Eudoxia with Agalma, or the adult stage of Diphyes with the corresponding larval condition, Agalma, is evidently legitimate, as the comparison of the developed bud of Lizzia with a genus similar to the Lizzia from which it budded. Although we have in Eudoxia an alternation of generation, it is unlike that condition in some other animals, as in the echinoderms, where the nurse cannot be homologized with the adult. In some respects it resembles most closely that process of growth which we are familiar with under the name of strobilation. The Eudoxia is the separated Ephyra, and the Diphyes is a free-swimming scyphistoma, as far as the relation of the nurse to the adult goes. Here however the parallelism ends. The same holds true also in a comparison of genera of Diphyidæ with the free-living proglottids of the tape worms (Leuckart, Siphonophoren von Nizza, p. 29). As McCrady has already pointed out (Lectures), there is a close resemblance between a Tænia and the Scyphistoma in mode of strobilation, but as there is no homology between the proglottids and the Ephyra, so there is little in common in the structure of the Diphyizoid and Ephyra. They resemble each other simply in the mode of strobilation.

The corresponding parts of an Agalma and an Eudoxia are given in the table below:

Agalma.	Eudoxia.
Float.	Covering-scale.
Nectocalyx.	Nectocalyx.
Polypite and tentacle.	Polypite and tentacle.
Covering-scale.	Covering-scale.
Taster and filament.	Wanting.
Sexual bells.	Sexual bells.

The axis or stem of Agalma is reduced in Eudoxia to the polypite condition, and is not distinguishable from this structure.

REMARKS ON THE CRETACEOUS AND TERTIARY FLORA OF THE WESTERN TERRITORIES.

BY LEO LESQUEREUX.

THE following notes were suggested by two valuable communications to *Nature*, in the numbers bearing date June 30 and October 6, 1881; the first, that of Dr. J. S. Newberry, tending to show that the flora of the Dakota group, together with that of the Laramie group, are of Cretaceous age; the second, that of J. Starkie Gardner, Esq., of London, contending to the contrary, that both those floras are Tertiary.

As there is not any fixed characters admitted as standard points of determination of the age of a fossil flora, phytopalæontologists have no means of coming to an understanding on the subject, except by a comparison of the vegetable remains of the divers formations with those of localities whose geological horizon has been ascertained.

I take here, for comparison with the plants of the Dakota group, the Upper Cretaceous flora of Groenland, Atane; that of Moletin, of Quedlinburg, of the Quader-sandstone of the Hartz and other localities of Germany where this formation, generally considered as Middle Cretaceous, or Cenomanian, has been observed.

One hundred and seventy specific forms of plants are now known from the Dakota group; they represent six ferns, one Equisetum, or seven cryptogamous acrogens; seven Cycadeæ, ten conifers, three monocotyledonous plants; the others, about one hundred and fifty, all dicotyledonous angiosperms.

As far as known until now, the flora of Atane, Groenland, is represented in sixty-three species—thirteen ferns, two Cycadeæ, ten conifers, three monocotyledonous, while thirty-four, or a little more than one-half, are angiosperms.

The relation of the Atane flora with that of the Dakota group is marked by ten identical species: one fern, two conifers and seven dicotyledonous; while quite as distinct an affinity is demonstrated by allied types of the genera Ficus, Sassafras, Diospyros and Sapindus.

The flora of Quedlinburg is composed of twenty species; four ferns, four conifers, one monocotyledonous, with eleven angiosperms, a little more than half of the species. Of this group of

plants, the relation to the flora of the Dakota group is shown by only one identical species, a fern, which is also found at Atane and Moletin, while analogy is marked by two species of Myrica and a Proteoides.

Moletin, in eighteen species described of its flora, has one fern, four conifers, one monocotyledonous and twelve angiospermous plants, these, therefore, constituting two-thirds of the flora.

Though the number is small, the flora is related to that of the Dakota group by identity of one fern, one conifer, both also recognized at Atane, and of two dicotyledonous species. This is a remarkably close relationship indeed, more intimate than that between the Quedlinburg and Moletin floras, and it is positive, for the species indicating it, *Gleichenia kurriana*, *Pinus quenstedti*, *Aralia formosa* and *Magnolia speciosa*, all described by Heer, are of easily identifiable characters.

The quader-sandstone of the Hartz is, by its numerous species of Credneria, related to the no less numerous representatives of the genus Protophyllum of the Dakota group.

In the Monde des Plantes, by Saporta, the author, who has had opportunity to compare specimens of plants of the Cenomanian of Bohemia with those of the more common and characteristic species of the Dakota group, remarks, p. 202, that the flora of this group presents, if not identical species with those of Bohemia and Moravia, at least a number of equivalent forms.

Mr. Feistmantel says, in a note to Professor Heer,[1] that the lower division of the Cretaceous of Bohemia (Perutzer-Schichten) is Cenomanian. After naming a number of plants found in the sandstone of this formation, he adds that the beds of shale, partly between, partly above the sandstone, contain remains of plants, ferns, conifers and a mass of dicotyledonous leaves and fresh-water shells. Of the forty-nine species determined by him, nine are also at Moletin, seven at Niedershoena, while three ferns and conifers are present in the Lower Cretaceous of Groenland, and four in the Upper, that of Atane. Of the same plants the Dakota group has five, positively identified: *Gleichenia kurriana*, *Pinus quenstedti*, *Sequoia Reichenbachi*, *Magnolia speciosa* and *Aralia formosa*. A sixth might be added, *Sequoia fastigiata*, but its identification is less definite. And still with the flora of Niedershoena, that of the American Cretaceous is related by one identi-

[1] Fl. Arc., Vol. III, p. 3.

cal species, and the affinity of character of a Pterophyllum, a Caulinites, a Fagus, two species of Ficus, a Myrica and a Daphnogene.

To set aside the evidence derived from the remains of plants indicating synchronism and Cretaceous age of the localities above named, it may be said, as it has been done for the Laramie group, that vegetable remains are not sufficient authority for the determination of the age of a formation.

But here the determination of the formation from where the remains are derived, has been first made, or later confirmed by the characters of animal remains found in the intercalated or superposed strata. Heer states that the Moletin formation is positively referable to the quader-sandstone, Cenomanian, overlying the planer of Reuss referred to the Turonian; and of that of Quedlinburg, he states that it is referable to the lowest zone of the *Belemnitella quadrata*, which constitutes the lowest stage of the Senonian or Upper Cretaceous. In the quader-sandstein of the Hartz, from where the Credneria species have been obtained, a large number of animal remains, mostly of invertebrate and fishes, have been found. Stiehler, in his Beiträge,[1] quotes a long list of these genera and species, all Cretaceous. It is the same with the animal remains found in the strata overlaying the Dakota group in a space of more than two thousand feet.

The objection by Mr. Gardner is, that these so-called Cretaceous animal remains may not or are not generally or specifically identical with those of the Middle Cretaceous of England. Of this I am unable to judge. But it is said also that the vegetable types of the Dakota group appear too young to represent a Cretaceous formation, for some of them are closely related to plants of the Miocene. This is true, as it will be seen here below; but that cannot be taken into account in the discussion, for the relation is quite as prominent, rather still more marked with species of the present vegetation of North America, where a number of types of the flora of the Dakota group are reproduced in some of the more important and beautiful trees of our forests. This is the more remarkable that the affinity is not at all observable with the plants of the Lower Tertiary or Eocene of the Laramie group. But this refers to the second part of the discussion; before coming to it there are still a few words to say on the present objection.

[1] Beiträge zur Kentniss der Vorweltlichen Flora, 1857.

The Lowest Cretaceous flora of Groenland, that of Come, is composed, as far as known, of seventy-five species, of which forty-two represent Cryptogamous acrogens, ferns, Lycopods and Equisetaceæ; nine Cycadeæ, seventeen conifers, six monocotyledonous and only one dicotyledonous angiosperm plant. Composed as it is, the group has rather the character of a Jurassic than of a Cretaceous flora. It is, however, related with Atane by five identical species, three ferns and two conifers, and also by that first or more ancient dicotyledonous plant, a Populus of the same type as three other forms of this genus described from Atane.

What conclusions can be derived from the above? The character of the flora of Come being Jurassic, the formation which it characterizes cannot be considered as Tertiary. Heer thinks even that the true Cretaceous begins with the flora of Atane. But admitting Come as lowest Cretaceous, we may follow the relation of its flora through Atane, not only with the Dakota group, but with all the formations mentioned above from Germany—Quedlinburg, Moletin, the Quader-sandstone and others; and, therefore, to admit the Dakota group to the Tertiary, it would be necessary to erase from the Cretaceous, as it is constituted, the whole of the formations related to it with Come, or the whole of the formations where angiospermous plants have been found.

On the second question considered in the memoirs of Mr. Starkie Gardner and Dr. Newberry, or the relative age of the Cretaceous and Lower Tertiary formations of North America in comparison with those of England, I have to omit the facts derived from animal palæontology. I can only briefly remark on the affinity and disparity of some vegetable types of the Dakota group compared to those of the American Eocene (the so-called Laramie or Lignitic group); of the Miocene of Carbon, and on the relation of the plants of the Lignitic with those of the Eocene of England and France.

From what is known until now of the plants of the American formations named above, the flora of the Dakota group is, as said already, more distinctly related by analogy and identity of species to that of the Miocene than to that of the Lignitic. Except the close affinity remarked between *Cinnamomum Heerii* (U. S. Geol. Rept., VI, p. 84, Pl. XXVIII, f. 11) and *Cinnamomum affine* (same Rept., VII, Pl. XXXVII, f. 1–5, 7), I do not know of any Cretaceous

species which can be pointed out as indicating a distinct relation to plants of the Laramie group. Leaves of Cinnamomum have been described by Dr. Newberry from the Orcas island (Descriptions of fossil plants collected by Mr. G. Gibbs) and supposed by the author to be referable, partly at least, to *Cinnamomum Heerii*, described first from Vancouver's island. The author's remark, that the specimens, though typically allied to *Cinnamomum Scheuchzeri and C. lanceolatum*, indicate a larger and thicker leaf, confirms his supposition; for *Cinnamomum Heerii*, of which a fine specimen, preserved entire, has been obtained this year in Kansas for the Museum of Comparative Zoölogy of Cambridge, merely differs from *C. affine*, found at Golden and Carbon, by its more rounded base, both species being represented by leaves equally large and subcoriaceous. This form, therefore, passes to the Miocene through the Eocene without apparent modification. Of smaller leaves described from specimens of the Dakota group as *Cinnamomum Scheuchzeri*, a species of which two fine specimens have been also procured this year in Kansas, none have been seen in the plants of the Lignitic. The ferns of the last group also are without analogy to those published by Heer and myself from the Dakota group. The same can be said of the conifers, except *Abietites dubius*, which according to Saporta, has, by the scars left by the base of the leaves upon the stems, some analogy with Cunninghamites, a Cretaceous type. In the monocotyledonous, the palms especially, in the angiosperms the types of Populus, Platanus, Quercus, Ficus, Laurus, Viburnum, Rhamnus, Juglans, etc., all appear without relation to any of those of the Dakota group. Per contra, when comparing the plants of this Cretaceous formation with those of the Miocene of Carbon, even of the Pliocene of California, we find closely allied types, even identity of characters in species of Salix and still more in those of Populus. For example, between *Populus elliptica* Newby., Illustr. of species, Pl. III, f. 1–2, of the Dakota group, and *P. cuneata* Newby., *ibid.*, Pl. XIV, f. 1–4, of the Union group, no possible difference is found in the shape, size and nervation of the leaves. In the Cretaceous species, the borders are a little more distinctly crenate-serrate. But such a difference is of no account in leaves of the same type as the polymorphous *Populus arctica*, whose borders are entire or undulate, or more or less deeply serrate-crenate. Liriodendron and sassafras, not at all represented in the Laramie, are found in

the Miocene, especially in that of Europe, in remarkably similar forms of leaves. Even *Liriodendron giganteum* of the Dakota group, considering the leaves only, is reproduced in *L. tulipifera* of the present North American flora. The same observation can be made on Fagus and Quercus, in comparing *Fagus polyclada* and *Quercus primordialis* of the Cretaceous, which without representative in the plants of the Laramie group, have species of similar type in the Miocene and also in the flora of this epoch. The Cretaceous *Platanus primæva* is comparable to the Miocene *P. gulielmæ*, while of the types of Aralia, so remarkaby abundant in the Cretaceous of Kansas, two are found at Carbon and Evanston, and none in the Lignitic. *Aralia quinquepartita*, figured U. S. Geol. Repts., VII, Pl. XV, f. 6, and still from better specimen, Vol. VIII (ined.), Pl. VII, f. 4, is reproduced in *Aralia augustiloba* of the Pliocene (gold gravel formation) of California. More of this same kind of analogy could be given, but the above is sufficient to prove that the characters of the flora of the Laramie group, or Eocene, greatly differ both from those of the Cretaceous and of the Miocene of this continent.

That they are related, and some of them positively identical with those of the Eocene of Europe, is remarked by Dr. Gardner, who has found in the Eocene of England, among a number of ferns, two species identified in the flora of the Laramie group. The table in the U. S. Geol. Repts., Vol. VII, p. 314, etc., indicates the relation of the plants of the Lignitic with those of different formations and localities as it was known when the volume was published. With the flora of Sezane, for example, the affinity is marked by twenty-one species. Since then a new kind of palm Ludoviopsis, obtained at Golden, indicates affinity to a species of Sezane, and another that of a finely preserved dicotyledonous leaf, figured in the same volume, Pl. XV, f. 5, is recognized by Saporta as identical to one of his species of the same locality, *Sterculia modesta*, thus increasing in a remarkable degree, the evidence of the relation of the flora of the Laramie group with that of the Eocene of Sezane.

But the review and discussion of the data concerning the Tertiary age of the Lignitic may be now of little importance, as all the phytopalæontologists who have entered into the discussion, have recognized the Tertiary characters of its flora. For it is evident that a number of the species described as Mio-

cene by Dr. Newberry from the Fort Union group, are identical with those abundantly represented at Golden. If this fact has not been acknowledged by the eminent geologist of New York, the cause is most probably due to the mingling of the specimens submitted to him, which, derived from divers localities, were representatives of two formations, but were labeled as from the same locality, as would be, for example, the specimens of Carbon mixed with those of Golden, or those of Washakie mixed with those of Black Butte. A lot of specimens sent to me by the U. S. Geol. Survey, and labeled Point of Rocks, were certainly obtained from the Washakie group, as all represent Miocene species without analogy to those collected later by Dr. Hayden at Point of Rocks. This supposition only can explain the aggregation in the same geological group, of species like *Taxodium occidentale*, the large palms, *Sabal Campbelli*, the remarkable leaves of *Platanus Haydeni*, *P. Raynoldsi*, *Tilia antiqua*, etc., with such positively Miocene plants as *Sequoia Langsdorffi*, the forms of Populus allied to *P. arctica*, even species of our time, *Onoclea sensibilis*, *Corylus Americana*, *C. rostrata*, etc. All this gives to the Union group an evident Miocene facies, and therefore, from this consideration only, and in substituting Miocene for Tertiary, it would be possible and right to say, that no Miocene plant has been found in the Laramie group.

On the identity of some of the species of plants of the Union group with those of the Laramie, there is no possible doubt. The most abundant remains procured at the Raton mountains, by divers explorations, represent *Sabal Campbelli*; some of the finest specimens procured at Golden are of *Platanus Haydeni* and *P. Raynoldsi*. Some large pieces of sandstone, procured at Golden for the Museum of Princeton College, represent both the species figured in the illustrations of Dr. Newberry, Pls. XIX and XXI. And as all the specimens I have described from the collection made by the Geological Survey of Dr. F. V. Hayden, are now deposited in the National Museum, the determination of the species can be there critically examined.

STRUCTURE AND OVARIAN INCUBATION OF GAMBUSIA PATRUELIS, A TOP-MINNOW.[1]

BY JOHN A. RYDER.

SINCE we have taken up our temporary residence at Cherrystone we have found this interesting genus of cyprinodonts in great abundance in fresh and brackish water streams, also in a fresh water pond in the vicinity, a few miles south of where our station is located. In the latter situation three forms have been collected all of which are in breeding condition—we will not say spawning condition, as they do not, as do most other fishes, commit their ova to the care of the element in which they live, but carry them about in the ovary, where they are impregnated and where they develop in a very remarkable manner.

Of the manner of impregnation we know little or nothing, except the evidence furnished by the conformation of the external genitalia of the two sexes. In the adult male, which measures one and one-eighth of an inch in length, the anal fin is strangely modified into an intromittent organ for the conveyance of the milt into the ovary of the female; a tubular organ appears to be formed by the three foremost anal rays, but one which is greatly prolonged and united by a membrane. At the apex these rays are somewhat curved toward each other, and thus form a blunt point, but the foremost one of the three rays is armed for its whole length with ridges at its base and with sharp recurved hooks at its tip, the other two at their tips similarly with hooks, and between their tips are two small fenestra or openings which possibly communicate directly with the sperm duct from the testes. The basal elements of the fin are aggregated into a cylindrical columnar truncated bony mass, which is prolonged upward into the cavity of the air-bladder for the distance of nearly the eighth of an inch; from it a series of fibrous bands pass to the dorsal and posterior wall of the air-bladder to be inserted in the median line. Whether this bony column serves to steady the fin in the act of copulation, or whether it serves to give passage to the sperm duct, is an unsettled question with the writer. The modified anal fin of the male measures a third of an inch in length. Other peculiarities of the male are noticeable—for instance, as the more abbreviated air-bladder or space which also occupies a more oblique

[1] From the *Forest and Stream*, New York, Aug. 18, 1881, with notes and corrections.

position than in the female. The most remarkable difference presented by the male as compared with the female, however, is his inconsiderable weight, which is only 160 milligrammes, while that of the gravid female is 1030 milligrammes, or nearly six and one-half times the weight of the male.

The female, as already stated, is larger than the male, and measures one inch and three-fourths in length. The liver lies for the most part on the left side. The intestine makes one turn upon itself in the fore part of the body cavity and passes back along the floor of the abdomen to the vent. The air-bladder occupies two-fifths of the abdominal cavity, and at its posterior end the wolffian duct traverses it vertically, to be enlarged near its outlet into a fusiform urinary bladder of very much the same form as in many embryo fishes. The ovary is a simple, unpaired organ which lies somewhat to the right and extends from the anterior portion of the body cavity to its hinder end, and serves to fill up its lower moiety when fully developed. The ova, when full grown, are each enveloped in a sac or follicle supplied with blood from a median vascular trunk which divides and subdivides as it traverses the ovary lengthwise in a manner similar to that of the stem to which grapes in the bunch are attached. In this way it happens that each egg or ovum has it own independent supply of blood from the general vascular system of the mother, from which the material for the growth and maturation of the egg is derived, and which afterward becomes specialized into a contrivance by which the life of the developing embryo is maintained while undergoing development in their respective follicles in the ovary or egg-bag. The ova develop along the course of the main vessel and its branches, as may be learned upon examining a hardened specimen, where the very immature ovarian eggs are seen to be involved in a meshwork of connective fibrous tissue, which serves not only to strengthen the vessels but also afterward enters into the structure of the walls of the ovarian sacs or follicles externally.

The very immature eggs measure from less than a hundredth of an inch up to a fiftieth, and on up to a twelfth of an inch, when they may be said to be mature. They develop along a nearly median rachis or stalk which extends backward and slightly downward, and which gets its blood supply very far forward from the dorsal aorta. The ova, after developing a little way, are each inclosed in a follicle, the Græfian follicle, ovisac, ovarian capsule,

membrana granulosa of Von Baer, or *membrana cellulosa* of Coste. As the egg is matured there is a space developed about it which is said to result from the breaking up of the granular layer of cells covering it. This space is filled with fluid, and in this liquid, which increases in quantity as development proceeds, the embryo top-minnow is constantly bathed. *There is no trace whatever in the egg of this fish of an independent egg membrane*, as is the case with all known forms which spawn directly into the water, and which is usually, if not in all cases, perforated by one or more micropylar openings or pores for the entrance of the spermatozoön. This fact raises the question whether the egg membrane or *zona radiata* usually present in the ova of water-spawning fishes is not entirely absent in all the viviparous species. Whether Rathke has recorded anything on this point in his account of the development of Zoarces, the viviparous blenny, I am not able to say at present, as I do not have access to his memoir.[1] Suffice it to say, however, that with very cautious preparation, staining and dissection of the follicles inclosing the ova of Gambusia, I have completely failed to discover what I could regard as an egg membrane, although personally familiar with the appearance of the coverings of the ova of more than twenty species, embracing fifteen or more families. The *zona radiata* or covering of the egg in other bony fishes is said to be secreted from the cells lining the follicles and is composed of a gelatinoid substance, and it is often perforated all over by a vast number of extremely fine tubules, called pore canals by their discoverer, Johannes Mueller. No such structure existing as a covering for the egg of Gambusia, we are in a position to ask the question why such an unique condition of affairs should exist in this case? The answer, it would appear to us, is not far to seek. In the case of eggs which ordinarily hatch in water it is necessary that they should be supplied with a covering more or less firm and capable of protecting the contained embryo, which in the case of the top-minnow is not needed, because the embryo is developed so as to be quite competent to take care of itself as a very well organized little fish

[1] Rathke's description accords pretty closely with my account of the egg follicles of Gambusia given farther on. The narrow, elongate stigma, devoid of vessels, on the follicle, spoken of on page 4 of his memoir on Zoarces, probably corresponds to what I have called the *follicular foramen*. He has described a vascular network in the follicle, a stalk joining it to the vascular rachis and a space around the yelk much as in Gambusia.

when it leaves the body of its parent. Nature will not waste her powers in an effort to make useless clothes for such of her children as do not need them; on the contrary, she is constantly utilizing structures economically, and often so as to serve more than one purpose. This is the apparent answer to the query with which we started.

The follicles or sacs containing the ova are built up internally of flat, polygonal cells of pavement epithelium, and externally of a network of multipolar, fibrous, connective tissue cells and minute capillary blood vessels, with cellular walls, which radiate in all directions over the follicle from the point where the main arterial vessel joins the follicle, and which, together with its accompanying veins and investment of fibrous tissue, constitutes the stalk by which the follicle and its contained naked ovum is suspended to the main arterial trunk and vein. The capillary system ends in a larger venous trunk, which also follows the course of the main median arterial trunk back to the heart by way of the Cuvierian ducts. The very intricate mesh-work of fine vessels which covers the follicle supplies the developing fish with fresh oxygen, and also serves to carry off the carbonic dioxide in much the same way as the placenta or after-birth performs a similar duty for the young mammal developing in the uterus of its parent. There is this great difference, however, between the fish and the mammal. In the former there is no uterus; the development takes place in the follicle in which the eggs have grown and matured; there is no true placenta, but respiration is effected by a follicular mesh-work of blood vessels, and the interchange of oxygen and carbonic dioxide gases takes place through the intermediation at first of the fluid by which the embryo is surrounded in its follicle, and later when blood vessels and gills have developed in the embryo they, too, become accessories to aid in the oxygenation of its blood. In the mammal there is a uterus; the egg must leave its ovarian follicle; be conveyed to the uterine cavity before a perfectly normal development can begin; there is a fully developed richly vascular placenta joined to the fœtus, the villi or vascular loops of which are insinuated between those developed on the maternal surface of the uterine cavity. In both fish and mammal, however, this general likeness remains; that there is no immediate vascular connection between mother and embryo. In both the respiration of the embryo is effected by the transpiration of

gases through the intermediation of membranes and fluids, oxygen being constantly supplied and carbonic dioxide carried off by means of a specialized portion of the blood system of the maternal organism.

There is still another difference which distinguishes the developing fish from the mammal, which has not been noticed. The body of the former is built up by a gradual transformation or conversion of the substance of the yelk into the various structures which make up its organization. In other words, the young fish obtains no nutrition from its parent; there is merely an incorporation of the stored protoplasm of the yelk sack. In the mammal, on the other hand, the embryo receives nourishment through the placental structures, the largest proportion of the embryo is built up from the protoplasm supplied from the blood system of the parent. Judging from the large size of the young of some viviparous fishes, such as in Embiotoca, it is possible that there may be some exceptions to the rule indicated above.

Besides the very intricate network of capillary vessels which covers the follicles of the ovary of Gambusia, a large opening of a circular or oval form makes its appearance in the wall of each one at or near the point of attachment of the vascular stalk by which they are supported. This opening appears to increase in size as the young fish develops; whether it is present during the earliest stages of the intrafollicular development of the embryo I do not know, as I did not have an opportunity to see those phases. A branch from the main nutritive vessel frequently lies near the margin of the opening, curving around it. Whether this opening serves the same purpose as the micropyle of ova provided with a membrane, would appear very probable, as it is difficult to see in what other manner the milt, which is probably introduced into the ovarian cavity by the male, could reach the ovum through the wall of its follicle. The opening into the follicle may be named the *follicular foramen*. Through it the cavity in which the embryo lies is brought into direct communication with the general ovarian space.

We found ourselves unable to determine the species of the form, the structure of which is described above; none of those described in Jordan's Manual appear to agree with our species. It may be, as some of us have surmised, that the isolation of the form on the eastern peninsula of Virginia, for a great length of

time, may have served to develop specific characters, and that it is undescribed. We leave the determination of the species to the systematic ichthyologists.[1]

Thus far our account has dealt only with the structure of the adults and the peculiar contrivances by means of which reproduction is effected; we will now take up the discussion of the egg and the embryo.

The globular vitellus measures about a line in diameter including the embryonic or germinal portion. The germinal protoplasm probably occupies a peripheral position covering the nutritive or vitelline portion of the egg as a continuous envelope with strands of germinal matter running from it through and among the corpuscles of the vitellus. This peripheral germinal layer, when the egg is ready to be fertilized, migrates toward one pole and assumes a biscuit shape. This is essentially the history of the formation of the germinal disk of the Teleostean egg as worked out independently by Coste, Kupffer and the writer. Little of a trustworthy character is known of the history of the germinative vesicle and spot, which bear the same relation to the egg as the nucleus and nucleolus do to the substance of the cell of the ordinary type. When cleavage of the germinal disk has begun, *it is the first positive evidence that impregnation has been successful.* The disk then begins to spread over the vitellus or yelk and soon acquires the form of a watch glass, with its concave side lying next to the surface of the yelk. Coincident with the lateral expansion of the germinal disk, a thickening appears at one point in its margin which is the first sign of the appearance of the embryo fish. With its still further expansion, the embryo is developed more from the margin of the disk toward its center; in this way it happens that the axis of the embryo lies in one of the radii of the disk; its head toward the center, its tail at the margin.

But before the embryo is fairly formed, a space appears under the disk, limited by the thickened rim of the latter, and the embryo at one side. This space, the segmentation cavity,[2] *is filled*

[1] Our original reference of this fish to Zygonectes has proved to be erroneous, the species proves to be *Gambusia patruelis* of Baird and Girard. Its discovery north of the mouth of the Chesapeake marks the northernmost limit of its occurrence yet known, most of the members of the genus being sub-tropical and West Indian.

[2] This cavity is the exact homologue of that in the batrachian ovum. In the fish and bird it is somewhat modified, and no doubt serves to enable the blastoderm to spread over the yelk as segmentation proceeds.

with fluid and grows with the growth of the germinal disk, as the latter becomes converted into the blastoderm, and does not disappear until some time after the embryo has left the egg as a young fish; and then it often remains as a space around the yelk sac for as long as a vestige of the latter remains, as may be seen in the young of Cybium, Parephippus, Gadus, Elacate and Syngnathus. In regard to this point, I hold views entirely different from any other observers, but inasmuch as the writer has had opportunities for the study of the development of a greater number of species, representing a greater number of families, than any previous investigator, and because the observations are based on material studied without the use of hardening re-agents which either deform or obliterate the segmentation cavity, and also because it was found to be present in all of the forms which were sufficiently well studied, it is believed that it will be found in the developing ova of most or all Teleostean fishes. Should this prove to be the fact, the Teleostean egg will be as distinctly defined in respect to the sum of the developmental characters which it presents, from the developing ova of other vertebrates, as the adult Teleost is from the remaining classes of the sub-kingdom to which it belongs. The floor of the cavity appears to be formed by the hypoblast or innermost embryonic layer, while its roof is formed by the epiblast or outermost skin layer. Gradually this blastoderm, which has been derived by cleavage from the germinal disk, grows over the yelk, no part of its epiblast layer being in direct contact with the hypoblast below on account of the presence of the intervening film of fluid, except at its rim. The embryo is also found to be in fixed contact with the yelk. The blastoderm grows at about an equal rate all around its margin; the point where the edges of the blastoderm finally close is almost directly opposite the site where the germinal disk first appeared; the closure at last occurs just behind the tail of the embryo where a little crater-like elevation marks the point at which it disappears. The embryo now lies along a meridian of the blastoderm; its head at the original germinal pole, its tail at the other. The growth of the blastoderm over the yelk is greatly facilitated by the film of fluid contained in the segmentation cavity, over which it can glide as it grows without friction. This view seems to me to be the most rational yet proposed in explanation of the method by which the blastoderm grows laterally in all directions

down over the yelk. In some cases the yelk sac is frequently much absorbed before the outer epiblastic sac begins to collapse. This is the case with Cybium after it leaves the egg, and proves very conclusively that the outer sac is entirely free, laterally and ventrally, from the inner one containing the yelk.

There are two principal methods by which the yelk is absorbed; the one where a more or less extensive net-work of vessels is developed over the surface of the yelk, and through which all, or nearly all, of the blood passes to reach the venous end of the heart; in many cases no such net-work is ever developed, as for instance, in the shad, mackerel cod and bonito. To the former class the young top-minnow belongs. Its yelk is orange-colored and imbedded in it superficially are a great number of refringent oil globules of small size. There appears to be a sinus beneath the head, continuous with the segmentation cavity in which the heart is developed. The body of the young fish lies in a groove or furrow on the surface of the yelk. This is the youngest state in which I have seen Gambusia, and explains why I have given the preceding general account of the development of a young fish. The somites or segments of muscle plates had been developed for some time. The heart, brain, intestine and organs of sense were defined.

The next important stage observed, was when the yelk sac was in great part absorbed and the fish nearly ready to hatch, or more properly to leave its follicle and the body of its parent. The extraordinary acceleration of development noted in almost every detail of structure, was such as I had never witnessed in any other species of young fish. The bones of the skull, although still cartilaginous, were advanced to a condition not seen in the shad until it has been hatched for three weeks or more. There were intermaxillary elements with teeth; pharyngeal patches of teeth; the brain was pretty well roofed over by the cartilaginous cranium; the branchiosteges were developed in cartilage; the opercles completely covered and concealed the gills, the opercular elements being differentiated; the gills already bore branchial leaflets; the neural and haemal arches of the vertebræ were being developed in cartilage; scales covered the sides and back and were developing in pockets of the dermal epithelium; in fine, all the fins were already developed except the ventrals with the same number of rays as in the adult, and yet the yelk sac was not nearly

absorbed. I have never seen in any fish embryos of the same age, an instance where scales were developed or where the fins had approximated their adult condition so nearly as in this case. The only instance known to me at this writing where a continuous dorsal and ventral median fin-fold is never developed, is in the case of Syngnathus, where the caudal rays are developed before the dorsal ones. Whether the unpaired fins of Gambusia are or are not derived from such a fold would be an interesting observation. A marked acceleration is also noticeable in the development of the brain, a study of which, by means of sections, as compared with that of the adult, has furnished me with some valuable clues in following up the development of Teleostean brains in general.

To sum up, this fish begins an independent career as far developed as when the shad, cod, mackerel, bonito and many other fishes are from three to six weeks old. By so much it has the advantage over those types in the struggle for existence in that it is ready to feed, to pursue its prey discriminately, as soon as it is born, while the other forms alluded to are comparatively helpless until some time after they have absorbed their yelk sacs, although most of them by that time have acquired mandibular, maxillary or pharyngeal teeth or both. The Fish Commission authorities need never be uneasy about the fate of the top-minnows; they will take care of themselves; their species is sure of survival. But our study, it would seem to the writer, has not been in vain, because, even though the fish is too small to be of any practical value, it has taught us that where nature has so effectually provided for the protection of the young fish, she does not require one adult to produce as many embryos. In Gambusia twenty-five to thirty young is perhaps the limit of production for a single female; in Apeltes, or the four-spined stickleback, the male of which is provided, according to my observations, with a spinning apparatus with which he fabricates a nest in which the young are hatched and taken care of, the number of eggs is from fifteen to twenty. Contrasting these small numbers with 100,000 to 3,000,000, the number of ova easily matured in a single season by a single female of many anadromous and marine species which have heavy, adhesive or floating eggs, it would appear that the quantity of germs produced by different species of fishes is in some way proportioned to their chances of survi-

val. Otherwise we are at a loss to explain the enormous fertility of many marine forms; the astounding fertility of the oyster and clam are other instances illustrating this principle, where ova are matured by the tens of millions, but where barely one out of a million survives so as to attain adult age.

Certain adaptations of structure are also plainly noticeable on a comparative study of fish ova. Thus the egg membrane of floating eggs is extremely thin, thinner than that of heavy or adhesive eggs, while the thickest membranes are those provided with external filamentous appendages. The most thinly clad hatch out soonest. May it not be that the thinness of the envelope of the egg has some relation to the rapidity with which the oxygenation of the egg is effected, and consequently with the rapidity of tissue and embryonic changes? And, finally, who would undertake to say that all of these modifications of the embryonic envelope are not such as could be developed by natural selection so as to favor the survival of the greatest number of embryos?

Many other general views of a similar character might be drawn from the material in my possession, but I fear that there has been already too much detail entered into for this note to be of interest to the general reader.

Before closing I wish to state that it is the oviduct of the female in some cyprinodonts that is prolonged into a tube at the anterior edge of the anal fin. This difference, as compared with Gambusia, would be useful as a generic character, as suggested by Colonel Marshall McDonald, to whose unselfish, helpful interest I am deeply indebted for assistance in manifold ways, while the investigation of the material was in progress, upon which the foregoing account is based.[1]

[1] The only memoir which I have been able to find bearing on the development of a cyprinodont is that by M. Duvernoy, *Sur le developpement de la Pœcilia surinamensis, Ann. Sci. Nat., 3 Ser., I. 1844.* His account has however been based upon alcoholic material, but shows the remarkable acceleration of development of the embryos the same as in Gambusia. The number of embryos, their arrangement in the ovary, and the position of the ovary itself appear also to be similar.

Laboratory of the Experimental Station of the U. S. Fish Commission, Cherrystone, Va., August 10, 1881.

NOTE ON A FEW OF THE USEFUL PLANTS OF NORTHERN JAPAN.

BY PROFESSOR D. P. PENHALLOW.

THE object of the following lines is, not so much to draw attention to the plants which are generally recognized as of great value to man, as it is to bring to notice plants less widely known for their useful properties and in which special interest centers, either from the novelty of their use or the fact that, while but little known, they possess qualities which, under the improvement of cultivation, would render them highly desirable acquisitions wherever they can be grown.

Depending upon the natural products of the uncultivated soil to supplement the products of the chase, the aborigines of Yesso have long since discovered whatever plants are of real value, either as articles of food, or as furnishing material for their few and simple manufactures, and some of these they have turned to such good account, that they are worthy of more than casual notice.

Various species of Lilium abound throughout the forests, and all those which furnish a sufficiently large bulb, are utilized as a source of farinaceous food. Early in autumn the women may be seen returning to their villages loaded with bulbs. These are thoroughly crushed in a large wooden mortar, after which the starch is separated from the cellular mass by repeated washing. The former is then dried and hung up in bags for winter use, while the latter is dried in round, perforated cakes somewhat resembling miniature mill-stones, and hung up to dry. Later, it serves as food for the Aino and for the caged bears which are generally to be met with wherever there is a small settlement. The Japanese hold the lily bulbs, as a source of farinaceous food, in great esteem, and the demand for them is so great that they are cultivated *(L. bulbiferum)* in large quantities and form one of the prominent farm products to be seen in the market. The bulbs are simply boiled and eaten as potatoes would be. From personal experience we are able to certify as to their qualities. It is somewhat more difficult, however, to give testimony bearing upon the flavor and desirable qualities of flowers and buds from various species of Hemerocallis. In certain sections of the island, particularly on the pumice formation of the east coast, these plants

are particularly abundant, and at the time of blossoming, the fields, for miles along the road on either side, are an almost uniform golden yellow. At such a time the Aino women may be seen busily engaged gathering the flowers which they take home and dry, or pickle in salt. They are afterwards used in soups. I have been told that the Japanese make a similar use of them, but probably only to a very limited extent.

In the *Pitasites japonicus* Miq., or fuki, both Japanese and Aino find an article of food which they seem to hold in high esteem. During early summer, the leaves make a very rank growth, often reaching a height of three feet. While in the early stages of growth, the petioles are succulent and crisp, and are largely used in soups. They are devoid of flavor and it is difficult to conceive what quality they possess which should recommend them as an article of food. The fact remains, however, that they are not only collected from the woods, but the plants have even been brought into cultivation expressly for their succulent petioles. The fuki is common everywhere in Yesso, being abundant not only in the villages, but it is found to extend well up the mountain slopes and frequently occurs at an elevation of 3000 feet.

Not less interesting is the similar use which the Japanese make of the bur-dock root, *Lappa major* Gaert., which attains great length under cultivation, but as an article of food is tasteless, hard and fibrous.

The horned fruits of the *Trapa bispinosa* Roxb., var. *incisa*, which is common in all the large ponds, are largely used by the Aino, and to some extent by the Japanese, for food.

Turning our attention to those plants which yield something of more evident value, we find in the *Actinidia arguta*, or kokuwa, a vine which gives promise of being a valuable acquisition to our New England flora. The vine is common in all the valleys of Yesso, and extends southward to Central Niphon. Vigorous in growth and fruiting abundantly, it can be trained like a grape-vine. The fruit is an oblong, greenish berry about one inch in length. The pulp is of uniform texture, seeds minute and skin thin. When fully ripe they possess a very delicate flavor. Aside from its fruit, the plant is of value as an ornamental vine, on account of its fine foliage. A somewhat less desirable plant is found in its congener, *A. polygama*, which grows in more elevated places, fruits less abundantly and is not so rich in foliage.

Arundinaria japonica is so abundant everywhere, from bottom lands to the summits of mountains over 4000 feet in height, and its rhizomes form such a strong network just below the surface, rendering it exceedingly difficult to properly clear the land and plough it, that the plant, from the farmer's standpoint, is regarded as an intolerable nuisance; nevertheless it possesses some qualities which render it of considerable value. Like the true bamboo, the wood is exceedingly strong and elastic, and finds many useful employments in a variety of manufactures. It likewise serves as an important material in the construction of houses and fences. During the winter months, when all else is covered with snow, the yet green, though dry and silicious leaves furnish almost the only food for the numerous wild deer, and constitute a very large part of the diet of the hard-worked and much-abused pack-horses. When the young shoots appear in early summer, they are carefully gathered, and under the name of *take-no-ko* are used for food as we would employ young asparagus; though by no means so tender as the latter, they make a very desirable dish.

The clothing of the Aino, though to some extent made of cotton cloth obtained from the Japanese, is almost entirely a product of their own industry, and made of such material as can be found in the fibers of wild plants.[1] The fiber for their cloth is obtained from both the *Ulmus campestris* and *U. montana.*

The long leaves of the *Typha latifolia*, or kina, serve the same people with most admirable material for floor mats. Each summer long excursions are made to the localities where the plant is particularly abundant, and large quantities of leaves are gathered and prepared for winter employment.

The bark and leaves of *Prunus padus* have long furnished the principal medicine in use by the Aino, and it is interesting to observe that they have been employed in precisely those disorders for which our *P. virginiana* bark is used.

Another plant which is held in high esteem for its medicinal properties, is a species of Acorus, the roots of which are employed in cases of dysentery with good effect.

[1] See AMERICAN NATURALIST for August, 1880.

HABITS OF BUTTERFLIES.[1]

BY W. H. EDWARDS.

I. On certain habits of Heliconia charitonia Linn., a species of butterfly found in Florida.—According to Wallace and Bates all species of Heliconidæ have so obnoxious a smell and taste by reason of the pungent odor which seems to pervade their systems, that birds will not touch them, though their flight is so early and their abundance so great all through the tropics, that they could be caught more easily than most other butterflies. So lizards and monkeys refuse them.

Heliconia charitonia is common at Indian river, being a forest species, and Dr. Wm. Wittfield observed three of these butterflies fixed upon a chrysalis of the same species in the forest last May. He watched them off and on for two days, and tried to drive them away, picking them off with the fingers, but they returned to the same position, and remained there till the morning of the third day, when he found all gone, and the empty shell of the chrysalis only remaining.

This led him to raise another chrysalis, which he placed in a flower bed frequented by *H. charitonia.* Soon some butterflies came and touched the chrysalis, but its wriggling caused them to move off. Two days before the imago was due, and before discoloration of the shell of the chrysalis had commenced, they attached themselves again, two or three at a time, and as before, would only yield to force, and then returned. On the third day all had gone and the empty shell remained. Query: Did the butterflies, aware of their own immunity from persecution, gather for the purpose of guarding the chrysalis from attacks of birds or other enemies, just at the time when it was most defenceless; or were they attracted by sexual desire, the imago perhaps being of the opposite sex to the butterflies gathered upon it?[2]

II. On an alleged abnormal peculiarity in the history of Argynnis myrina.—Mr. Scudder, in the AMERICAN NATURALIST, 1872, related "The Curious History of a Butterfly," and stated that in both *A. myrina* and *bellona* occurred a phenomenon which he considered unique among butterflies; there being two sets of individuals, each following its own cycle of changes, apparently with as little to do with the other set as if it were a different spe-

[1] Read at the Cincinnati meeting of the Amer. Assoc. Adv. Science.

[2] Later observations show that the chrysalids guarded as related are female, and the assembled butterflies are always male.

cies; each set having its own distinct seasons, and thus giving rise to the apparition of two or three successive broods in the course of the year. He regarded these series as distinct from each other as any two species, and offering differences such as usually characterize somewhat distinct genera.

All this was based upon what the author stated to be a fact, that the eggs of these species are wholly undeveloped at the birth of the female, and that they are not developed for weeks or months, so that what appears to be two successive broods of the butterflies cannot possibly be such, as one cannot be descended from the other. Any one, in fact, must have come direct from the second brood back of it and not the first.

Mr. Edwards ascertained in 1875, '76, and '77, by breeding *A. myrina* in the Catskill mountains (in part, bringing the eggs or caterpillars to Coalburgh, W. Va.) that the foregoing statement was based in error. That the females at birth have fully developed eggs, requiring but impregnation, and that they are laid almost immediately; in fact, two of his butterflies paired a few hours after both emerged from the chrysalis. Eggs were laid to the number of ninety-three, within forty-eight hours from chrysalis, and they produced caterpillars. Also that other points in Mr. Scudder's curious history were made in error; and his observations were published in the *Canadian Entomologist*. Nevertheless, in his work on Butterflies, Mr. Scudder repeats the same story, with no verification or data whatever, and with no direct allusion to the published refutation.

Mr. Edwards stated that *Thecla henrici* Grote, lays its eggs on the wild plum at the base of the plum stalks; the young larvæ climb the stalks and eat a hole in the side of the small plum, and thereafter continued to feed on the inner part of the plum, going to another when the first is excavated. The species is single-brooded, appearing in April, about the time the wild plum trees are coming into bloom (in West Virginia).

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

——The popular view as to the definition of science, if we are to judge from the subject matter of "scientific columns" in our newspapers and magazines, is somewhat wide of the mark. It is evidently not well understood that the application of science to practical life is not science itself, and should be treated of under a

distinct name. Science (including metaphysics) embraces the description of the properties of bodies, and of the general laws which are derived therefrom. The processes necessary for accomplishing these ends, including deductive reasoning, are included, as accessories, under the same general head. But the manifold uses of the knowledge thus acquired are not science, but art. Not fine art of course, but mechanic art, medical art, etc. Mechanic art is the application to human uses of the facts and laws of physical and mathematical sciences. Medical art is an application of the facts and laws of anatomical and physiological science. The pursuit of applied science is always a shorter road to popular favor than the cultivation of pure science. People are naturally impressed by their senses, and they easily confound the exhibitor with the creator. Moreover the genius displayed by the inventor is like that of the artist proper, a wonderful attribute of the human mind. It is only second in rank to the power of discovering new truth, and it excites our wonder the more, because it is more automatic. *Omne ignotum pro mirabile* is a saying which describes the average sentiment of humanity. With lucid explanation, wonder ceases, for "anybody can understand it." From time immemorial the worker in mysteries has commanded the admiration and purses of mankind, while the expounder of truth has scarcely been tolerated. But it is becoming generally known that all mysteries yield to the solvent of investigation, and that when the web is unraveled, it is found to consist of the universal raw material, put together by the ordinary laws of necessity which reason discloses. Nevetherless mental automatism remains, after consciousness, the second wonder of the universe, whether it be displayed in scientific or artistic labor. While science has her true field—the discovery of truth, it will ever be the glory of art to apply it to human necessities and pleasures.

——In the death of the Hon. Lewis H. Morgan, American science loses one of its original thinkers, and one of its most indefatigable workers. His work on ancient society is "epoch-making," and advanced the science to a new stage of its history. In selecting the industrial history of mankind as the true test of his progress, Mr. Morgan applied the idea, subsequently worked out by Herbert Spencer, that the industrial form of society is a higher type than the militant, and is more prosperous, and more permanent. It is the available test of the progress of intelligence among primitive races; and the progress of intelligence is the evolution of man. We are satisfied that Mr. Morgan's general ethnologic system will remain, whatever may become of some of the details, and that his name will stand as that of the first of American thinkers in the high field of anthropology, up to this date. Like other

men who are ahead of their generation, Mr. Morgan did not receive the popular recognition which was his due and which his native modesty forbade him to seek; but that his work rewarded him with true satisfaction cannot be doubted by those who knew him.

——Congress will soon be occupied with the question of the revision of the tariff. We have already referred[1] to the tax on intellectual progress which has been imposed in the shape of duties on books, apparatus and specimens necessary for private students of natural history in this country. No congressman familiar with the situation would countenance such a piece of medieval barbarism, and if scientists will act in the premises, we have not a doubt that the objectionable legislation will be repealed this winter. But we must act. Let every subscriber to the NATURALIST write to his representative in Congress, and ask for his influence in favor of repeal. Congressmen will naturally give the preference to those objects to which their attention is most urgently directed.

——American "Academies of Science" are frequently constituted like stock corporations, with a sufficient sprinkling of scientific men to furnish credit to the remaining members. Sometimes the president is a scientific man, but the secretary, like those of corporations, is generally selected for his clerical ability; so also many of the other officers. The Philadelphia Academy of Natural Sciences has lately done itself the honor of electing one of its most distinguished scientific members to the office of president. We refer to Professor Joseph Leidy. This is a step in the right direction, and one to be followed we hope by many others of the same kind.

——An American cotemporary accuses the NATURALIST of appropriating from its pages a notice of Dr. Hahn's so-called organic remains in meteorites. The note in question was taken from the Journal of the Royal Microscopical Society of London, and by an oversight was not credited to that source. The failure to credit the article will however hardly be regretted by its author.

——Of all the experts examined during the Guiteau trial, Dr. Edward Spitzka, of New York, seems to be the only one to recognize the fact that a man may be insane by malformation, and not be more diseased than a man with strabismus or with six fingers.

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RECENT LITERATURE.

HABIT AND INTELLIGENCE, by Joseph John Murphy.[2] This is a thoroughly well written and thoughtful work, and one which will well repay perusal even by those who are not prepared to accept the conclusions which the author himself asserts rather than endeavors to prove.

The writer is a thorough evolutionist in so far as the doctrine

[1] NATURALIST, February, 1881.

[2] *Habit and Intelligence;* a series of Essays on the Laws of Life and Mind. By JOSEPH JOHN MURPHY. Second Edition Illustrated. pp. 585. London. Macmillan & Co. 1879.

of evolution applies to organic life. He sees his way clearly for the continued development of life from the simplest protoplasmic protozoan upward to the complex bodily and mental organization of the higher mammals and of man himself. He traces with due precision the differentiation of a nervous system, and the gradual growth therefrom of the powers to which we give the names of consciousness, mind, and intelligence—the latter of which is but the result of consciousness. He perceives, in concert with most American naturalists, the insufficiency of Darwin's theory of "natural selection" to account for the *origin* of the slightest variation, though he admits, with some hesitation and occasional contradiction of himself, its efficiency to preserve a beneficial variation when it has once arisen. To refute Darwin he gleans facts and theories from Cope, Mivart, Wallace, and other naturalists, accepts also the aid of the physicists who deny the possibility of the countless millions of years required by the "natural selection" theory; and succeeds in fortifying himself in a position from which it would be difficult indeed for a pure Darwinian to dislodge him. But he dismisses in few words Spencer's masterly theory of the influence of the total environment upon an organism, and scarcely notices Cope and Hyatt's proofs of the ease with which new genera can be produced by an acceleration or retardation of the embryological stages of life.

Having thrown doubt upon Darwin, he is in a hurry to assert that all evolution is the result of a "Formative Intelligence" originally impressed upon organic existence from a source outside of them.

He does not admit the possibility of the evolution of the lowest protoplasmic life from inorganic matter; and still less can he conceive of the evolution from simple matter of the molecules of the so-called elements of the chemist. Upon such subjects as the origin of life the only safe position is that of the agnostic; we do not "know," we have no "positive proof," similar to that which tells us of our own existence, or informs us of the existence of tangible objects. But the agnostic may have his opinion, his belief, comparable to the beliefs and creeds of the religions and sects, and like them, incapable of "positive proof." But while the belief of the creeds is based upon a book or upon traditions, the opinions of the agnostic, held by him loosely and susceptible of modification in the face of new discoveries, are always in harmony with the facts of which we have "positive proof," and do but form their logical continuation.

Such a statement as that on page 41 of Mr. Murphy's book—"the notion of any finite thing existing without having been created is more inconceivable—it is absurd," proves nothing and disproves nothing. We admit that it is inconceivable, it is "too high, we cannot attain unto it," yet it is simpler than the belief in a Creator who breathed into certain particles of matter

a "Formative Intelligence," and then left that intelligence, distributed among a number of organisms struggling for existence, to take care of itself, and to develop into higher life through an ordeal of suffering and in spite of imperfection, disease, and the dying out of individuals and of species; without taking any further interest in the life he had created. Still more is it simpler than to conceive of an omnipotent, omnipresent, personal, and good God who, after creating life, watches and sustains it, yet permits an evil spirit to exist, and allows pain and disease to mar the beauty of his creation. To conceive of the matter of the universe as capable of evolving conscientiousness is past our mental power, but is the difficulty removed by having to account also for the origin, existence and habitat of a non-material Creator who beneficently allows a non-material destroyer to play havoc with his creation? On this subject Mr. Murphy does but assert his opinions, his argument really stops with the accumulation of proofs of the coëxistence of intelligence with life—a point in which we cordially agree with him, objecting only to his term "unconscious intelligence," as applied to the acts of the lower animals. In this matter we would go further than Mr. Murphy. Proud man, ignorant of the inner life of the lower animals, finds it difficult to stand outside of his individuality sufficiently to judge fairly of their actions. Our author quotes the building of hexagonal cells by the honey-bee as an instance of unconscious intelligence. We believe, in the light of the numerous observations made by Lubbock, McCook, and others on hymenopterous insects, that one or several bees discovered this economical form of cell just as man stumbles, by simply trying, on the greater part of his discoveries. To account for the perpetuation of the discovery when made we have no need to call in "natural selection," or any power more abstruse than that of inter-communication, which is well known to be possessed in a high degree by ants and bees.

One of the principal points sought to be made out in favor of a "formative impulse" is the development of structure in advance of function, as evidenced in the metamorphoses of the Hydroida, Ascidia, Crustacea, and Batrachia, in all of which the writer contends that structures useless to the possessor are laid down in anticipation of a future development, in which such structures are useful. Such structures are the long abdomen of a Zoea, useless (our author asserts) to the Zoea, but coming into use in the lobster; the notochord of the Ascidian, destined to be aborted, but foreshadowing that of the vertebrate; the incomplete medusa buds of some hydroids, anticipatory of the free medusæ of others; and the transition from swimming bladder to lung, foreshadowed in Ganoids and Dipnoans, and carried out in the Batrachia. A teleologist might reasonably query by what process of reasoning it is provable that these structures,

transitional though they may appear to us, are not of use to their possessors. But the gradual evolution of a structure not yet become functionally useful, is but a parallel case with the persistence for a long period of structure no longer functionally useful. The wonder is rather, when we review the wondrous changes passed through in the life history of an animal or of a plant, from the seed to the tree, from the egg to the free embryo and thence to adult life, that all works so truly as it does, and that variation is not more frequent. The slightest over-development of one organ, or arrest of development of another, caused by the surrounding environment or by heredity (the effect of the environment of ancestors) may change the genus, the change may neither be useful or hurtful, yet its tendency is to continue when commenced, and it may, in process of time, become functionally useful. On the other hand, a useful variation may take place suddenly (as we see in Amblystoma) and a hurtful one is put an end to by the death of the possessor. We commend this book to the notice of our readers.

SOUTHALL'S PLIOCENE MAN IN AMERICA.[1]—The author evidently means well enough in writing this pamphlet, but he appears to start with the idea that geology is an exact science, that we know the precise time, even geologically speaking, when the Pliocene epoch ended and the Quaternary began, and that certain haphazard estimates of the time in years that man has been on the earth made by an accomplished zoölogist like Mr. A. R. Wallace, who has, however, published little or nothing original upon palæontology or geology, are of real value. So when ten years ago a "Mr. Vivian and Mr. A. R. Wallace claimed for [man] an antiquity of 1,000,000 and 500,000 years" we do not see why Mr. Southall or any other man should in 1881, get into a flurry over the matter, unless he wants to make himself conspicuous as a critic of geologists and geological reasoning in general. Confining ourselves to the points of most importance in the query as to the age of Pliocene man, the geologist wants to know the limits of the Pliocene in western America. What Whitney calls Pliocene deposits may be contemporary with the incoming of the glacial period in eastern America, or it may be a transition period between the Pliocene and Quarternary period. As we understand it, the age of those lower level gold-bearing sands and gravels is quite uncertain, and they may, contrary to Whitney's opinion, be no older than our eastern boulder clays. Moreover what Mr. Southall overlooks, none of the specimens of human art found on the Pacific coast, in so-called Pliocene deposits, have been taken out either by the hands of or in the presence of a geologist, not even of Professor

[1] *Pliocene Man in America.* By JAMES C. SOUTHALL, being a paper read before the Victoria Institute, or Philosophical Society of Great Britain, with remarks by His Grace the Duke of Argyll, Professor W. Boyd Dawkins, Principal Dawson, Professor T.McK. Hughes, and others. London. [1881.] 8vo, pp. 30.

Whitney himself, and while we may accept nearly all of the statements Whitney makes at second hand, the testimony is of course weakened by this fact. Until, then, geologists who are also palæontologists, which Professor Whitney would not claim to be, have settled the age of our western gold drift, which may turn out to be no older than our eastern glacial drift, we do not see why the layman should not wait until geologists agree in the matter. At any rate the present pamphlet is a confused and hasty statement of conclusions from a mass of indigested and necessarily vague notions of a few geologists, naturalists and historians (the latter most worthy men, but not claiming to know anything about the Pliocene, or any other geological period). We doubt whether one geologist in a hundred thinks man is older than the glacial period, while if well verified facts warranted the conclusion, they would willingly allow that man lived not only through the Pliocene, but began his existence in the Chalk period. The true scientist is willing to follow the lead of facts; critics, such as our author, seem anxious to prejudice good people against geology and geologists, and to forestall public opinion on questions about which geologists themselves are divided and uncertain from the very nature of the evidence with which they are dealing. Perhaps before 1872 Mr. Dawkins would have made the same overstatements that Lyell made previous to 1872. There is a tendency in the mind of a scientific discoverer to overestimate in his enthusiasm the tendency of new found facts, and to at first exaggerate the importance of the results of his discovery. But for a critic after the lapse of ten or fifteen years to "run a muck" at such men, as though the same opinions were now held as ten or fifteen years ago, is to mislead good people who cannot distinguish between blind and indiscriminating, ignorant pseudo-criticism and the habit on the part of every candid scientific man to abandon extreme views if fresh discoveries teach him to hold more moderate ones. The pamphlet is only of value as containing remarks of Professors Dawkins, Dawson, Hughes and others, who cannot speak without saying something of interest.

Miss Ormerod's Manual of Injurious Insects.[1]—This is a well executed compilation from the best and most recent English sources, and reflects much credit on the judgment and skill of the authoress. It is devoted to "Food Crops and the Insects that injure them," "Forest Trees and the Insects that injure them," and finally to "Fruit Crops and the Insects that injure them." It closes with a glossary, and begins with a brief introduction to entomology. The illustrations are abundant, and their value is assured by the fact that they are mostly copied from Curtis and

[1] *A Manual of Injurious Insects*, with Methods of Prevention and remedy for their attacks to Food Crops, Forest Trees, and Fruit, and with a short introduction to entomology. By Eleanor A. Ormerod, F.M.S., &c. London, W. Swan Sonnenschein & Allens. (1881.) 12mo., pp. 323.

Westwood. Miss Ormerod has evidently taken a good deal of pains with the subject of remedies, and here the book is strong. We have found a number of most useful hints for dealing with forest insects, which are quite new to us. The style is compact and clear, and the book as a whole is an excellent and useful one.

RECENT BOOKS AND PAMPHLETS.—Diptera, gesammelt von Hermann Krone auf den Aucklands-Inseln bei Gelegenheit der deutschen Venus-Expedition in den Jahren 1874 und 1875. Bearbeitet von Professor Josef Mik in Wien. From the Verhandl. der K. K. zool, bot. Ges. in Wien, 1881. From the author.

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GENERAL NOTES.

BOTANY.[1]

AN INSTANCE OF THE PHYSIOLOGICAL VALUE OF TRICHOMES.—The tissues of nascent organs are thin-walled, have a relatively large amount of protoplasm, and are gorged with nourishing sap. While in this condition they possess no air passages or cavities, and the stomata are consequently incapable of performing their function —they can no more "breathe" than can an animal with its lungs full of water. This formative period in the life of the tissues, however, is one in which a rapid supply of oxygen is required to carry on the metastatic changes incident to growth. This need is supplied by greatly increasing the surface of the organ bathed by the air, allowing a greater transfusion of oxygen through the uncuticularized surface walls. The expansion is secured by means of innumerable slender trichomes.

These trichomes are thus seen to be a provision for increasing the absorbing surface, to the end that abundant material may be supplied for metastasis.

As the tissues mature, the intercellular spaces beneath the stomata with their extensions ramifying throughout the organ become empty of sap and allow of the free circulation of air, while the cuticle becomes nearly or quite impervious. The oxygenation of the tissues is then more readily effected through internal communication; the hairs therefore disappear or are replaced by those serving a different purpose.—*J. C. Arthur.*

THE ARRANGEMENT OF FIBROUS ROOTS.—A few years ago, in harvesting about fifty bushels of beets of several varieties, my attention was drawn to a peculiarity in the arrangement of the fibrous roots of which till then I had been unaware. While the greater part of the beet was nearly or quite bare of rootlets these were very numerous and closely clustered in two vertical bands on opposite sides of the main root. Each band covered, say, one-tenth of the entire circumference, more or less. Later I observed just such an arrangement of the rootlets of turnips. But this year I have seen some turnips with the fibers in simple rows as in carrots and parsnips. In these last the rootlets are in vertical (or now and then somewhat spiral) rows. The number of rows seems to be always four, but so situated as in some degree to correspond with the *two bands* in beets and turnips; that is, the rows are not exactly equidistant, but are, as it were, arranged in two pairs on opposite sides of the main root, and yet so nearly equidistant that it is sometimes difficult to say which two constitute a pair. The intervals between the rows are commonly in the ratio of 5 to 7, or on a cross section the lines joining the rows would form a parallelogram whose sides would be about as 5 to 7.

The rootlets of carrots differ from those of turnips and beets in

[1]Edited by PROF. C. E. BESSEY, Ames, Iowa.

being thickened towards their base and this spreading laterally so as to give the surface of the carrot somewhat the appearance of having rings of growth. Furthermore these fibers instead of spreading out into the ground seem to hug the main root and are turned commonly to one side as if the carrot had been twisted in the pulling. Sometimes on the same root they are turned both ways, and generally or always more or less downward.

The rootlets of parsnips are distributed much as those of carrots, somewhat thickened at base, but generally much longer and more spreading and branching. They penetrate more deeply into the soil too and hence the difficulty of digging them. The rows of fibers seem to form a longer parallelogram than those of carrots, the sides being about as 4 to 7.

The rootlets in *curled dock (Rumex crispus)* are plainly in three rows (except in one forked root the larger branch of which had four distinct rows). Swamp dock *(R. verticillatus)* has the main root much divided, but the fibers of these divisions are mostly in fours, the rows perhaps not quite so regular as the three rows of the curled dock, still plainly to be distinguished.

The roots of evening primrose *(Œnothera biennis)* have rather large rootlets very plainly in three vertical rows.

I designed to make observations on other roots, but the cold weather has come on and frozen the ground.—*Charles Wright, Wethersfield, Conn., Dec.* 1881.

The Royal Gardens at Kew.—From the *Gardener's Chronicle* we learn that the Report on the progress and condition of the Royal Gardens at Kew, for the year 1880, has just been issued. Pending its receipt, the following will be found of interest. The number of visitors during the year amounted to very nearly three quarters of a million (723,681), the highest number for one day being 61,831. In the plant houses of the Botanic Gardens the palms have been entirely re-arranged owing to their crowded condition. In this department more space is urgently needed. The Arboretum suffered much from the frosts and gales of the winter of 1879–80. Curiously a number of Californian species suffered greatly from the inclemency of the weather; thus *Pinus insignis, P. muricata, P. sabiniana* and *Abies bracteata* were all more or less injured. *Pinus Elliottii* was also injured.

There are now no less than 220 species and varieties of Oaks grown in the Arboretum; 24 of Chestnuts, 34 of Beeches. A catalogue is in preparation "which will give the names of the principal species and varieties, with their native countries and synonyms." Such a catalogue from such a source can not fail to be of the highest value to botanists the world over, and its appearance will be looked for with interest by all.

The important economico-botanical collections from the India Museum at South Kensington were transferred to Kew during

the year 1880. This consisted of an immense quantity of material, from which the Kew authorities selected suites of specimens. Thus of rice alone "there were about two thousand samples, from the most widely distributed districts of India, and weighing in the aggregate about three tons. Every one of these was carefully examined and compared, and a series was separated showing every type of variation to which Indian rice is subject. The amount of this variation in form, color and texture is almost inconceivable, and the trouble and expense which must have been involved in the accumulation of the specimens, is amply justified by the clearness with which this fact is now brought out. In form the individual rice-grains vary from elongated to ovoid, in texture from translucent to pearl white opacity, in color from white to pink, brown, mottled, and even black."

In the Herbarium Dr. M. C. Cooke's services have been secured. He has undertaken the arrangement of the collections of thallophytes, especially of the fungi, "which, owing to the press of work in keeping the Phanerogams and Ferns constantly worked up, have been somewhat neglected." This latter announcement will be received with gratification by the many students of fungi in this country and England.

A General Index to the Journal of Botany.—James Britten announces a "General Index to the *Journal of Botany*," from its beginning to the end of Volume xx, to be published at six shillings (about $1.50) per copy, provided that a sufficient number of subscriptions are received. The importance of this index to all botanists, even in cases where complete sets of the Journal are not possessed, is so great that it is to be hoped that many orders will be sent from this country. Orders should be addressed to West, Newman & Co., 54 Hatton Garden, E. C., London, England. As Volume xx, will not be completed until the end of the year 1882, the index will not appear for a year or more.

Bentham on Gramineæ.—George Bentham read an important paper on the Gramineæ before the Linnean Society at its meeting November 3, 1881. He recognizes fourteen tribes which he disposes under two sub-orders, or families as follows:

A. Paniceæ.	*B.* Poaceæ.
Tribe 1. Paniceæ,	Tribe 7. Phalarideæ,
" 2. Maydeæ,	" 8. Agrostideæ,
" 3. Oryzeæ,	" 9. Isachneæ,
" 4. Tristegineæ,	" 10. Aveneæ,
" 5. Zoysieæ,	" 11. Chlorideæ,
" 6. Andropogoneæ,	" 12. Festuceæ,
	" 13. Hordeæ,
	" 14. Bambuseæ.

Botanical Notes.—A fine full-page cut of a beautiful aroid (*Taccarum Warmingianum* Engl.), recently introduced into English gardens from Brazil, is given in a late number of the

Gardener's Chronicle. The leaf which is pinnatified, is from two to two and a half feet wide, and is borne upon a thick petiole between three and four feet long. The spathe, fifteen inches long, and borne upon a scape eight inches high, is of a brown coppery tint inside mottled with green, while the spadix is of a pale pink color. It will doubtless prove to be a valuable acquisition to our list of ornamental plants.——Rev. M. J. Berkeley describes a new parasite upon the lilac in the *Gardener's Chronicle.* It is evidently one of the Peronosporeæ, and is named by Mr. Berkeley, *Ovularia syringæ.* The conidia (acrospores) are large and ovoid, and occur singly on the ends of the hyphæ which protrude through the stomata. The parasite "produces large brown patches, sometimes occupying almost the whole of the leaf." Has this yet appeared in this country?——A leaf of the giant water lily *(Victoria regia)* growing in Lake Nuna in Peru is recorded by Paul Marcoy in the *Wiener Illustrirte Gartenzeitung* as having a circumference ot 24 feet 9¼ inches, and weighing between 13 and 14 pounds. One of the flowers measured 4 feet 2 inches in circumference, and weighed three and a half pounds. The outer petals were nine inches in length.——Dr. Vasey in the December *Botanical Gazette* describes three new species of grasses, viz: *Melica Hallii* from Colorado and the Great Plains of British America; *Sporobolus Jonesii* from Soda Springs, California, and *Poa purpurascens* from Oregon, and the Yellowstone region.—— In the same journal some one under the pseudonym of "Emesby" puts in a plea for Systematic Botany, or rather, it would appear, for what has been called Analytical Botany, as opposed to histological and physiological Botany. The writer apparently places a higher value upon the "identification" of a few plants, or the finding of a "new species" than upon that study of the structure and function of plants which alone can enable us to understand them *as living things.* His ideal botany is apparently one which culminates in the study and description of species!——M. Lechantier read a paper recently before the Academy of Sciences, Paris, upon the modifications in the composition of plants preserved in silos. Indian corn and clover lost a little of their nitrogenous matter; but the loss of glucosides was much greater; the chief loss being now in the glucose and sugar group, now in the starch and cellulose. Fatty matter, on the other hand, increased.——Part 1 of the "Transactions of the Massachusetts Horticultural Society" for 1881, has just appeared. It contains in addition to much of interest to horticulturists, many lists of trees, shrubs and other plants interesting to the botanist also.—— Figures and popular descriptions of the Short-leaved Skullcap *(Scutellaria brevifolia)* from Texas, and two fine species of Dahlia *(D. lutea* and *D. glabrata),* now rapidly coming into cultivation, are given in the December *American Agriculturist.*——Good figures of *Chara baltica* Bruz., var. *affinis* Groves, and *C. contraria*

Kuetz. accompany "Notes on British Characeæ" by H. and J. Groves in the December *Journal of Botany*.——The two delayed plates illustrating a paper on *Cinchona Ledgeriana* (from Bolivia), by Henry Trimen in the November *Journal of Botany*, appear in the December number. They are excellently done.

ZOOLOGY.

IS THE HUMAN SKULL BECOMING THINNER?—If the doctrines of evolution are true, and the evidence supporting them is of a convincing character, questions relating to the operation of the laws by which improvement or degradation results, become of particular importance when applied to the human race, and it is a matter of serious inquiry whether, under the altered conditions of civilization, causes may not be at work which operate to the disadvantage of the whole organism, by detracting from the efficiency of a part?

According to the theory as expounded by Darwin and others, we have the tendency of all organisms to accommodate themselves to their environment, and to adapt themselves to altered circumstances within certain limits, this principle of adaptation in cooperation with heredity, or the tendency of the offspring to inherit the characteristics of its progenitors, are made to account for much of the otherwise inexplicable phenomena with which we are surrounded.

Now according to this doctrine, an organism is endowed with ability to succeed amid certain surroundings—in the higher vertebrates, for example, we have the framework of bone, with all its beautiful applications of the principles of mechanics, so arranged as to prevent to a great extent injury of the important organs, and when we come to the brain, we find it enclosed in a rigid covering, capable of resisting a considerable degree of violence without being fractured, and evidently intended to protect the delicate organ it contains.

If we accept the tenets of evolutionists, a race adapted to certain circumstances, will, if those circumstances be altered, become modified in a corresponding degree, and retrogression may result as well as improvement, and this modification may be confined to a certain part or organ. Let us consider, therefore, what forces have exerted their influence upon this casket of the brain.

First, natural selection in the case of those creatures that engaged in fierce combats, would tend to eliminate those individuals with frail craniums, and as man comes within the category of belligerent creatures, when barbaric warfare, and the dangers of the chase were common occurrences, natural selection would of course exercise a powerful influence in maintaining a standard of cranial strength. Then, too, in the presence of repeated violence, adaptation would undoubtedly provide a suitable armor for this delicate and important organ. And as it is difficult to conceive

how the weight of its contents or the action of its muscles can exert any considerable influence upon its greater portion in man, the above may be regarded as the principal agencies, for sexual selection is confined to capabilities of an active character, and attributes which are displayed, and would be inoperative upon a hidden part, the function of which is only passive.

In civilized man, however, at all events in the higher grades of modern civilization, natural selection may be said to exert no influence in this direction, war is too infrequent and engages too small a portion of mankind, while the forces with which it deals, are of a nature to alter the whole aspect of the case. And while adaptation undoubtedly operates, particularly among the laboring classes, upon other portions of the frame to maintain their rigidity, it is only in rare instances that the skull is called upon to support any greater pressure than that exerted by the head gear.

It is not to be overlooked in this connection, that among semi-civilized peoples where the facilities for transportation are limited, the head is often made to support considerable weights, and except where rigid rules of caste prevent the intermarriage of classes, the joint action of adaptation and heredity disseminate the effects of this custom throughout the community.

There probably never was a time in the history of the world, when the skull was subjected to so little violence, as since the introduction of modern methods of transportation, and when we recall the fact, that it was but a few centuries ago, that the most advanced nations of the present day were barbaric, it is too soon to look for any great change. Yet it is not uncommon to hear of cases of fracture of the skull, which are ascribed to its unusual thinness. May not these be the results of fortuitous coöperations of the agencies mentioned?

If the force of the position assumed is accepted, the logical conclusion is that we are approaching a time when the human cranium will become much thinner, so delicate, in fact, that it will be easily fractured, we may therefore expect a revival of natural selection, and an increase of cases of death from violence to the head.—*W. B. Cooper.*

Habits of the Fierasfer, a Boarder in the Sea-Cucumber.—The Holothurians or sea-cucumbers have been long known by fishermen to harbor a curious fish, to which Cuvier gave the name *Fierasfer*. Several species of it are known. The most common in the Mediterranean, the *Fierasfer acus*, has been recently made an object of special study by Professor Emery, at the zoölogical station at Naples.

To procure Holothurians tenanted by the fierasfer, it is necessary to seek the animals at a certain depth; those living near the shore do not usually contain them. The two Mediterranean species of holothurians, which are most frequently tenanted, are *Stichopus regalis* and *Holothuria tubulosa*. When these animals

are accumulated in certain quantity in the same tank, the little fishes ere long appear. According to Professor Emery, who has opened hundreds of holothurians in his search, the fierasfer is generally lodged in the cavity of the body. It penetrates first, as we shall see, by the anus into the intestine. Then it migrates into the pulmonary passages, the thin and delicate walls of which soon rupture in consequence, and allow the fish to pass into the peri-intestinal space.

When free, the fierasfer ordinarily swims in an oblique position, the head down and the tail curved towards the back. By undulatory movements of its ventral fin, it moves obliquely forward, keeping about the same level, or obliquely in the direction of the axis of the body. It is but a poor swimmer, and when placed in a tank along with other fishes it is soon devoured, being incapable of flight, of defending itself, or of hiding in a medium uninhabitable by it.

Swimming with its head downwards, the fierasfer explores the bottom of the water and the bodies lying there. If it comes upon a holothurian, it immediately shows some agitation, examines the object on all sides, and having reached one of the extremities, examines it attentively. If it be the head-extremity, the fish returns suddenly, and proceeds to the opposite end, by which the holothurian sucks in and expels the water necessary to its existance. Then commences a curious proceeding. In the time of expiration, when the holothurian is expelling water, the little fish, excited by this mechanical action, applies its snout strenuouly to the anal orifice, then curves back its pointed tail over one side of its body, and by a rapid movement of recoil, introduces the tail into the rectum of the holothurian. This accomplished, the fish raises the anterior part of its body, while its tail remains pinched in the holothurian, and pushes itself further and further in with each movement of suction. After a time the anterior part enters in its turn, and the fish is completely inclosed in its host.

Professor Emery has sometimes seen a small fierasfer get into its position at once, while in other cases the progress of the fish is so slow that the patience of the observer is exhausted. While the general mode of introduction is that described, there may be some modifications. Thus the fierasfer may penetrate head-first, or, victim of a mistake, may endeavor, generally without success, to effect an entrance by the mouth of the holothurian.

The fierasfer is not necessarily solitary; on the contrary, it often shares its abode with two or three of its kind. Professor Emery has seen, in the Naples aquarium, seven fierasfers successively enter the same holothurian, causing their host injuries which proved fatal.

It has already been stated that the fierasfer does not remain in the intestine, which is difficultly habitable because of the quantity of sand in it. We have to note, however, that it always remains

near the anus, though which it protrudes its head, from time to time, in search of food. Thus it is not, in any way, either a parasite or a commensal, in the sense attached to these words in natural history—that is to say, it does not live at the expense of the holothurian, either consuming its substance or taking some of the food that animal has amassed for itself. Hence the earlier naturalists who studied the habits of the fish were mistaken in considering it as an example of parasitism by a vertebrate animal. The fierasfer is merely, as Professor Emery puts it, a lodger, or tenant.

According to Professor Semper, of Wurtzburg, however, there is on the coast of the Philippine islands, a small fish of the genus *Encheliophis*, closely allied to fierasfer, which, also living in holothurians, feeds on their viscera, and is, therefore, a true parasite. —*English Mechanic.*

HABITS OF THE MENOPOMA.—Having recently collected specimens of the common Menopoma *(M. alleghaniensis)* for Professor Ward's museum in Rochester, N. Y., I give some of my observations on its habits.

All my specimens were caught in the Loyalhanna creek, Westmoreland Co., Pa. It is well known to those accustomed to fish in the streams of this region, from its troublesome habit of taking bait placed in the water for nobler game. When thus hooked, its vicious biting and squirming, together with the slime which its skin secretes, render it exceedingly disagreeable to handle. It is often hooked in bottom fishing for catfish. Many anglers cut the hook off, rather than extract it, and the amphibian's flat head is often rendered still flatter by a lively application of the sportsman's boot heel.

In the early summer when the water is clear, Menopomæ are often to be seen on the pebbly bottom in considerable numbers. Once when fishing with some friends from off a large rock in the Loyalhanna creek, we saw quite a shoal of them moving sluggishly about among the stones on the bottom. They would quickly take our hooks baited with a piece of meat or a fish head. In one instance two large ones laid hold of the same bait and were promptly landed on the rock. In a few minutes we had a dozen. Last August I fished the same spot for them but without success. Acting on the advice of a "native" (which was to drop some bait—dead fish, &c., near certain rocks under which he insisted the "alligators" staid) I caught ten large specimens in a single morning, and ten more a few days later. Those taken were of various sizes, measuring from ten to eighteen inches in length. One taken by a friend was twenty-two inches long. Fishermen hereabouts say they have frequently caught hell-benders two feet long.

They are remarkably tenacious of life. I carried my specimens

six miles in a bag behind me on horseback, under a blazing hot sun, and kept them five weeks in a tub of water without a morsel to eat, and when I came to put them in alcohol they seemed almost as fresh as ever. During their confinement in the tub, two of the females deposited a large amount of spawn. This spawn was something similar to frog spawn in its general appearance, but the mass had not the dark colors of the latter. The ova were exuded in strings and were much farther apart than frog eggs. They were of a yellow color, while the glutinous mass which connected them had a grayish appearance. The spawn seemed to expand greatly by absorption of water. It lay in the tub among the animals for a week but was not disturbed by them.

The Menopona, here called "alligator" and "water dog," is an exceedingly voracious animal, feeding on fish, worms, crayfish, &c. Some of those taken by me disgorged crayfish shortly after being caught. Its large mouth which literally stretches "from ear to ear," takes in almost any bait not too large to be swallowed. May it not be a sort of scavenger of the water? It inhabits the Mississippi and Ohio rivers and their tributaries.—*Chas. H. Townsend.*

The Sparrow Pest in Australia.—Through the kindness of a correspondent I have received an interesting official document showing that *Passer domesticus* has proved not less obnoxious in Australia than in this country. It is a folio of eleven pages, being the progress-report of a commission appointed by His Excellency, Sir W. F. D. Jervois, Major-General, &c., to inquire into and report upon the "alleged injuries by sparrows" together with an analysis of correspondence and minutes of proceedings of the commissioners, published in September, 1881, at Adelaide by order of the House of Assembly. "The commissioners appointed to inquire into the alleged damages caused by sparrows to horticulture and agriculture in South Australia, and into remedial measures, and to report thereon, having proof of the evil existing in great force, and over larger districts of country, and being convinced that their suppression is urgent before another harvest and fruit season sets in, and before another nesting season (now beginning) shall swell their numbers, beg to present a progress report," &c.

The analysis of correspondence on the questions of inquiry shows: 1. That the sparrow is established over an immense area in South Australia. 2. That sufferers in such area "cry for relief from sparrow depredations as if from a pest." 3. That the sparrows are increasing at an astonishing and alarming rate, their work being "done under conditions despairing to the cultivator, and under conditions that he cannot control; for the seed is taken out of the ground, the fruit-bud off the tree, the sprouting vegetable as fast as it grows, and the fruit ere it is ripe." 4. The cultivated plants attacked are apricots, cherries, figs, apples, grapes,

peaches, plums, pears, nectarines, loquats, olives—wheat and barley—peas, cabbages, cauliflowers and garden seeds generally. 5. All means of defence have hitherto proved inadequate. 6. The commissioners suggest in addition to the usual means of defence, the tender of rewards for sparrows' eggs and heads; the removal of gun-licenses for the season, poisoned water in summer, sulphur fumes under roosts at night, plaster of paris mixed with oatmeal and water. "It is further declared that the *united action* of all property holders, including the government, *is essential* to effective results."

The state of the case in Australia being no worse than it is in the United States, these sensible and energetic measures contrast favorably with the neglect and indifference we have shown in so practically important a matter, notwithstanding the unceasing protests of all competent judges, chiefly through our long-suffering national good-nature, partly through sickly sentiment, and in some slight degree through the ranting pseudo-zoöphily of such persons as Mr. Henry Bergh, for example.—*Elliott Coues, Washington, D. C.*

Occurrence of the Opossum in Central New York.—Dr. W. H. Gregg of Elmira informs me that an opossum was last spring taken about 6 miles from the city, being the first specimen known to him to have occurred in that locality, which is certainly beyond the usual range of the species as commonly understood. —*Elliott Coues, Washington, D. C.*

The Claw on the "Index" Finger of the Cathartidæ.—

December 7, 1881.

To the Editors of the American Naturalist.

Gentlemen:—I read with much interest Dr. Shufeldt's article in your journal for November last, on the claw on the "index"[1] of the *Cathartidæ*, to the existence of which he had previously called my attention when I had the pleasure of making his acquaintence in Washington last month. Dr. Shufeldt certainly deserves great credit for being the first to detect a structure, which has previously, so far I am aware, escaped the notice of all observers. I may add that since my return I have been able to confirm the truth of Dr. Shufeldt's statements on specimens of *Cathartes aura* and *C. atratus* in my possession.

Allow me, as one perhaps more favorably situated than Dr. Shufeldt has been as regards the literature of ornithology, to call my friend's attention to Nitzsch's "Osteographische Beiträge zur Naturgeschichte der Vögel," published at Leipzig in 1881. In that[2] he will find an excellent account of the claw and phalanx in question as it exists in many other birds.

[1] The digit of the Avian manus called "index" by Professor Owen is now universally recognized by anatomists as really the pollex.

[2] "Ueber das Nagelglied der Flügelfinger, besonders der Daumen." pp. 89–97.

Nitzsch does not seem to have observed it in the *Cathartidæ*, but found it in *Haliaëtus albicilla*, *Tinnunculus alaudarius* and some others of the Falconidæ. It is very conspicuous in Pandion. In fact, the occurrence of such a claw is of very frequent occurrence in the class Aves, though by no means universal amongst them. Amongst birds in which it may be well seen, I may mention *Struthio* and *Rhea*, *Cypselus*, *Caprimulgus*, the *Rallidæ* and *Parridæ*. Such a claw must not be confounded, as has been done by some writers, with the long "spurs" covered by epidermic tissues, formed by outgrowths from the *metacarpal* elements, of most birds as *Parra*, *Palamedea*, *Plectropterus*, &c. In fact, the two may, as in *Parra* or *Plectropterus*, coëxist. Believe me, yours very truly,

W. A. FORBES,
Prosector to the Zoölogical Society of London.

A NEW DISTOMUM PARASITE IN THE EGG-SACKS OF APUS.—While opening the egg-sack of an *Apus lucasanus* from Kansas, my attention was attracted by a small cylindrical worm-like object attached to the walls of the interior of an egg-sack on the eleventh pair of feet. It is represented by the accompanying figure, which gives enlarged sketches of the side and under surface. The worm is 1 ¼ of a millemeter in length, and $\frac{4}{10}$ mm in thickness at the thickest part of the body, which is in the region of the sucker (*s*). Seen sidewise the body is moderately long and slender, a little curved and flattened on the concave side. The mouth (*m*) is situated near the end of the body, and is much smaller than the sucker (*s*). The anterior end of the body is not so much pointed as the posterior; the latter is somewhat produced, the end even somewhat incurved. The animal was white in color. This fluke may be called *Distomum apodis*. This is the first occurrence of any parasite on the members of this family *(Apodidæ)* of Phyllopods, and so far as we are aware the first instance of the occurrence of any parasitic worm in the Phyllopods in general. Living as it does in the ovisack, it can hardly be called an internal parasite.—*A. S. Packard, Jr.*

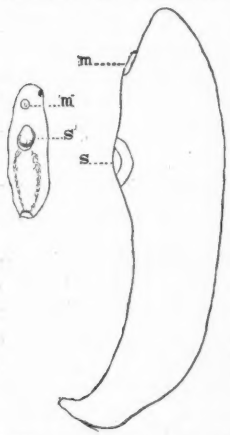

FIG. 1. — Diastomum of Apus, side and ventral view; *m*, mouth; *s*, sucker. Much enlarged.

ADDITIONAL NOTE ON THE EGG CASES OF PLANARIANS ECTOPARASITIC ON LIMULUS.—In the January number of this journal, by a curious coincidence, Dr. Gissler contributed a note covering in part the same ground as one by myself which appeared in the same issue. I desire to make a correction in regard to the supposed air-tubes alluded to by the former as occurring at the tips of

the egg-capsules. These are in fact nothing more than killed distorted protozoa of the genus Epistylis or Zoöthamnium, clusters of which I have frequently observed in the living condition on the ends of the egg-capsules in fresh material presenting almost precisely the appearance represented in Fig. 2 *b c*, of Gissler's note. They are present or absent according as opportunity may have been afforded for the protozoans to attach themselves, the oldest capsules and those from which the embryos had escaped, being the ones to which the Vorticellinæ had most often affixed themselves. At the time my note was written I did not think it worth while to mention the occurrence of the protozoa which are very common, the stalked forms especially. So numerous are these, in places, that to estimate their occurrence at one hundred per square inch of horizontal surface, we find the population of a square rod to be nearly four millions (more exactly 3,896,800). From what I have seen in the Chesapeake, this estimate, in many localities, would be very low, from which it may be inferred that the importance of the part played by the protozoa in the economy of the world of life is, like that of the earth-worm, not yet appreciated at its right value.—*J. A. Ryder.*

Notes on Some Fresh-water Crustacea, Together with Descriptions of Two New Species.—*Palæmon ohionis* Smith.—(*Palæmon ohionis.* Smith, S. I., Freshwater Crustacea, U. S. 640; Forbes, S. A., Bulletin Ills. Mus. Nat. Hist., No. 1, 5.) While seining for fishes in the vicinity of Vicksburg, Miss., during the past summer, I captured numerous specimens of this species. The largest specimens were taken in the open river with a small, fine-meshed, collecting seine. In some places they occur in enormous numbers. On the 4th of July we were in Louisiana, across the river from Vicksburg, seining in some ponds formed in the making of levées along Grant's canal. At a single draw of the net we brought out not less than a half bushel of these river shrimps. Considering their size and abounding numbers, they must constitute an important part of the food of the fishes of these waters. They are captured for bait, and are used to some extent for food; and I can, from actual experience, testify that they are not to be despised by the hungry hunter. My largest specimens agree exactly in size with those obtained by Professor Smith from the Ohio river at Cannelton, Ind. Many of the females were laden with eggs. The mandibles of this species, as in the case of many other crustaceans, are not perfectly symmetrical. The biting portions of the two mandibles are alike and tridentate. The triturating process of each is long, and stands out at right angles to the body of the mandible. That of the left mandible is truncated at nearly right angles; that of the left is quite oblique, so that a dentated edge is presented to the other mandible. Both molar surfaces are tuberculated.

Palæmonetes exilipes Stimpson.—(*Palæmonetes exilipes* Smith, S. I., loc. cit., 641; Forbes, S. A., loc. cit., 5.) I have collected this species in tributaries of the Tombigbee and Noxubee rivers, in Eastern Mississippi, in the Mississippi river at Memphis, in Pearl river at Jackson, and in the Chickasawha river at Enterprise, Miss. It is now known to occur as far north as Ecorse, Mich., in South Carolina and Florida, in Mississippi and in Illinois.

Crangonyx lucifugus, n. sp.—This is a small, rather elongated species, that was obtained from a well in Abingdon, Knox county, Illinois. As befits its subterranean mode of life, it is blind and of a pale color. In length the largest specimens measure about 6^{mm}.

Male.—Antennulæ scarcely one-half as long as the body. The third segment of the peduncle two-thirds as long as the second; this, two-thirds the length of the first. Flagellum consisting of about fourteen segments. The secondary flagellum very short, and with but two segments. Antennæ short, only half as long as the antennulæ. Last two segments of its peduncle elongated. Flagellum consisting of but about five segments, and shorter than the last two segments of the peduncle taken together.

Second pair of thoracic legs stouter than the first. Propodite of first pair quadrate, with nearly a right angle between the palmar and posterior margins. Palmar surface on each side of the cutting edge, with a row of about six notched and ciliated spines, one or two of which at the posterior angle are larger than the others. The cutting edge is entire. Dactylopodite as long as the palmar margin, and furnished along the concave edge with a few hairs.

Propodite of the second pair of legs ovate in outline, twice as long as broad. The palmar margin curving gradually into the posterior margin. The cutting edge of the palmar surface uneven, and having near the insertion of the dactyl a square projection. The palmar surface also armed with two rows of notched and ciliated spines, five in the inner row, seven in the outer. Dactyl short and stout.

Two posterior pairs of thoracic legs longest of all and about equal to each other. All the legs are stout and their basal segments squamiform.

Postero-lateral angle of first abdominal segment rounded; of second and third, from obtuse-angled to right-angled.

First pair of caudal stylets extending a little further back than the second; these exceeding slightly the third. The peduncle of the first pair somewhat curved, with the concavity above, the rami equal and two-thirds as long as the peduncle. The peduncle of the second pair little longer than the outer ramus. Inner ramus nearly twice as long as the outer. Third pair of caudal stylets rudimentary, consisting of but a single segment. This somewhat

longer than the telson, broadly ovate, two-thirds as broad as long and furnished at the tip with two short spines.

Telson a little longer than wide, narrowing a little to the truncated tip, which is provided at each postero-lateral angle with a couple of stout spines.

Female.—In the female the propodite of the anterior pair of feet resembles closely that of the corresponding foot of the male. The palmar margin of the second propodite is less oblique than in the second foot of the male, and does not pass so gradually into the posterior margin. It is also destitute of the jagged edge and the square process of the male foot. There are fewer spines along the margin. One of the spines at the posterior angle is very long and stout.

This species appears to resemble *C. tenuis* Smith, but is evidently different. In that species, as described by Prof. S. I. Smith, the first pair of feet are stouter than the second, and have the palmar margin of the propodite much more oblique. The reverse is true of the species I describe. Nor do I understand from the description of *C. tenuis* that the posterior caudal stylets each consist of a single segment. There are some minor differences. From *C. vitreus*, judging from Prof. Cope's description in AMERICAN NATURALIST, Vol. VI, p. 422, it must differ in the caudal stylets. "Penultimate segment, with a stout limb with two equal styles," is a statement that will not apply to my species, whichever the "penultimate" segment may be.

Crangonyx bifurcus, n. sp.—General form and appearance those of the Western variety of *C. gracilis*. Length of specimens about 9^{mm}. Eyes oval, black. Antennulæ scarcely half the length of the body. First two basal segments of the peduncle about equal in length; the first much the stouter; the third segment about two-thirds as long as the second. Primary flagellum about twice the length of the peduncle, consisting of about twenty-four segments. Secondary flagellum scarcely as long as the basal segment of the primary flagellum, consisting of but two segments. Antennæ about one-half as long as the antennulæ. Basal segments short, the first provided with a prominent process, which appears to be perforated (the opening of a gland?). Ultimate and penultimate segments of the peduncle elongated and equal in length. Flagellum shorter than the two distal segments of the peduncle and consisting of about eight segments. The antennæ furnished with about a dozen curious sensory organs; three of these on each of the two distal segments of the peduncle; the segments of the flagellum with one each, except the terminal three or four, which have none. These organs in alcoholic specimens resemble, under the microscope, a lanceolate or oblanceolate leaf having a midrib and parallel veinlets running from this to the margins.

Propodite of first thoracic foot subquadrate in outline; a very little longer than wide. Palmar surface somewhat oblique, armed

on each side of the cutting edge with about a dozen notched and ciliated spines. Two or three short, stout and serrated spines at the posterior angle. A number of stiff, slender hairs planted among the spines. Dactylopodite scythe-shaped, bent rather abruptly near the base, then straight, and finally incurved near the tip. Propodite of second foot more elongated than in the first foot, and with a more oblique palmar surface; armed with about fourteen spines along each side of the cutting edge. The first, second, and third abdominal segments have their postero-lateral angles drawn backward into a decided tooth.

Of the three pairs of caudal stylets, the first extends backward beyond the second; the second beyond the third. The latter consists of a stout peduncle and a single ramus, which is about two-thirds as long as the peduncle and provided with a few slender spines. There appears to be no inner ramus, but there is to be seen on the inner side of the ramus present a process of the peduncle that represents, perhaps, the inner ramus. There is, however, no involution of the integument at the base of this process. Telson elongated, twice as long as broad, the sides nearly parallel. The posterior border is provided with a notch that extends nearly three-fourths of the distance to the base. Each prong is armed at the tip with from three to five spines.

This species differs from *C. gracilis* more particularly in the form of the telson, and in the length of the outer ramus of the posterior stylets as compared with the peduncle. From *C. antennatum* Packard (AMERICAN NATURALIST, 1881, p. 880), it differs in the form of the telson, and in the much greater size of the eyes. Found by myself about 1st of April, 1880, in a rivulet flowing down the limestone hills into the Noxubee river, at Macon, Miss. Only four specimens were secured, all of which appear to be males.

The three species, *C. gracilis*, *C. bifurcus* and *C. lucifugus* present an interesting gradation in the forms of the posterior caudal stylets. In the first-named the outer ramus is twice the length of the peduncle, and the inner ramus is present, but rudimentary. In *C. bifurcus* the outer ramus is but two-thirds as long as the peduncle, while it is doubtful whether there is anything whatever to represent inner ramus. In *C. lucifugus* both the outer and inner rami are absent, and the peduncle itself is much reduced.—*(To be Continued).*—*O. P. Hay, Irvington, Ind.*

REVIVAL OF TARDIGRADES AFTER DESSICCATION.—The truth of the occurrence of this phenomenon has been denied by various observers, and the appearances explained by Ehrenberg as due to the development of fresh specimens from eggs left by the animals, which die in the process. Professor Yung, however, considers that his observation of the process, in a single specimen of Milnesium, proves the correctness of the old opinion. The specimen was taken from a ditch, contained eighteen eggs, and manifested

lively movements. It was left for five hours until quite dry, and all that could be seen of it under 350 diam., was a brown speck under the cover-glass. A drop of water was allowed to run beneath the latter. Almost immediately after it had reached the remains of the Tardigrade, a fine pellicle was evident, surrounding the brown speck and manifesting the general outlines of the body and ova. The normal wall then appeared, enclosing the contents of the intestine; the minutest details of the outer skin appeared; after twenty minutes the mouth with its fingers and tube, the jaws, and the feet were fully developed. Subsequently the parts connecting the jaws with the œsophagus came into view. No movements and no development of the ova were observed in the three hours occupied by these observations. The too close apposition of the cover-glass to the slide being now remedied, the animal was supplied plentifully with water, but, when searched for the next day, could not be found, having probably departed in search of more comfortable quarters, for the algae which had surrounded it were disturbed, and neither the remains of the jaws and skin, usually found after specimens have died, nor eggs, were discovered.

VARIATION IN ÆQUOREA FORSKALEA.—Professor C. Claus, according to the Journal of the Royal Microscopical Society of London, while giving an account of this Adriatic medusa, takes the opportunity of making some criticisms on Professor Haeckel's classification of the Æquoridæ. A careful study of this form has shown Claus that it is subject to extreme variation; variations so great as to have led Professor Haeckel to make a number of genera and sub-genera for their reception. It is not possible to abstract a critical paper of this kind, and we must be content to direct attention to the following points. Claus finds that the color varies with age and sex; the young may well be called *vitrina*, as Gosse called them; later on blue pigment-granules may appear in the ectoderm, and especially in the gonads of the male, while the female may take on a more or less reddish coloration (the *A. violacea* of Milne Edwards). The radial canals vary in number from just over fifty to nearly eighty. The form and size of the mouth-lips depend on the state of contraction of the specimen, on its age, and on the breadth of its umbrella. Altogether, according to Professor Claus, Haeckel would seem to have afforded a very interesting proof of the origin of species by variation.

DEVELOPMENT OF THE STERLET.—A résumé of Professor W. Salensky's Russian paper on this subject appears in the Journal of the Royal Microscopical Society. The segmentation of the egg is on the amphiblastula type; the gastrula, however, is an archigastrula. In the endodermal origin, and in the primitive formation of its mesoderm, the sterlet resembles Amphioxus, but

it differs from it in having the chorda dorsalis derived from the mesoderm, and not from the endoderm. There is no real difference in the mesodermal layer of these two forms, and intermediate stages between the two conditions have been observed in Elasmobranchs. So, also, the author thinks that the segmentation of the ovum presents a transitional arrangement between the bony fishes and Plagiostomes on the one hand, and the Cyclostomata and Amphibia on the other.

Zoological Notes.—The view that the Brachiopods are shelled worms, which has been so fully discussed and insisted upon by Professor E. S. Morse, appears to be gaining ground. Drs. O. and R. Hertwig in their lengthy essay on the cœlom theory agree with Gegenbaur that the Brachiopods have little more in common with the molluscs than the possession of a shell, the latter being wholly different from that of ordinary bivalves, and that they have taken their origin from the stem of the worms, especially the Chætopods.——It appears that two shells from Lake Tanganyika, in Central Africa, described in the Proceedings of the Zoological Society of London, and, according to a note by Dr. C. A. White in *Nature*, generically identical with the *Pyrgulifera humerosa* of Meek, from the Laramie group, an extensive brackish water formation in western North America; these beds being transitional between the Mesozoic and Cenozoic series.——In a paper recently read by M. Yung before the French Academy on the influence of the nature of food on sexuality, he states that he fed separate sets of tadpoles with fish, meat, coagulated albumen of hen's eggs, yellow of eggs, and with a mixed diet. These aliments do not appear to have had a very distinct influence on the sex; but along with M. Born's experiments, those of M. Yung support the idea that a special diet afforded to young tadpoles from the time of leaving the egg, favors the development of a female genital gland. This is the reverse of that arrived at by Hoffman, who found that deficiency of nourishment resulted in the case of plants, in the production of an excess of males. In a recent memoir entitled "Metagenesis und Hypogenesis von *Aurelia aurita*," Professor Haeckel by keeping a number of specimens in his aquarium, has observed certain phenomena in the mode of reproduction, which deviate from those which usually occur. Besides *metagenesis* or the ordinary development by alternate generation, he observed a direct development which he calls *hypogenesis*. This is effected by the gastrula developing directly into an Ephyra; the Scyphistoma and Strobila stages being suppressed. It remains to be seen whether this abbreviated mode of development occurs in a state of nature. Two large plates crowded with figures of generous size render the meaning of the text very clear. Indeed Haeckel's style is as clear and beautiful as his drawings and we wish all German scientific papers were as easy to read.——A fishing bat which lives in the caves at Mono island,

Trinadad, is described in *Nature*. These queer creatures catch fish at night in a manner not very clearly made out.——Dr. Kobelt, the malacologist, who has visited North Africa and Spain to study the mollusks of the two countries reports, says *Nature*, that it may be safely assumed that the connection was not confined to the Straits of Gibraltar, but extended at least as far as the meridian of Oran and Cartagena.—— M. Kunstler has found a flagellate Infusorian very much like Noctiluca living in fresh water.——It appears that 38 naturalists worked at the Roscoff sea-side laboratory during 1881 against 27 in 1880. The number of foreigners is eight.——The French dredging expedition, in *Le Travailleur*, under the direction of A. Milne Edwards, has published a preliminary report. Many crustaceans, and star-fish, such as Brisinga, and other animals were found, these being Atlantic forms new to the Mediterranean. "In general the Mediterranean is not to be thought a distinct geological province; its inhabitants have probably come from the ocean, and their development and reproduction have been more active than in their place of origin. Some have been slightly modified. The more we get to know of oceanic productions off the coast of Portugal, Spain, Morocco, and Senegal, the more do differences from Mediterranean animals disappear." *(Nature.)*——A species of fluke *(Distomum cirrigerum)* have been found by G. Zaddach in the crayfish, where they occur as blackish spots on the testes, and in greater numbers in the muscles of the hinder part of the abdomen. The author, says the *Journal* of the Royal Microscopical Society, comes to the somewhat remarkable conclusion that in *Distomum isostomum*, another fluke of the crayfish, the sexually mature forms succeed one another.

ENTOMOLOGY.[1]

On Some Curious Methods of Pupation among the Chalcididæ.—(*Concluded from the January number.*)—The mines of *Lithocolletis fitchella* Clem., at Washington, contain oftentimes a most interesting object, which I have never yet seen described. Imagine a short, slender chain of small, closely welded brown dipterous puparia and you will have the exact appearance. Such a chain I have often found in the center of a mine of the Lithocolletis, supported by the silken threads which the larva of the latter always spins prior to pupation. The number of individuals in a chain is always quite constant, never varying more than from ten to thirteen, and not a trace of any other occupant of the mine is to be seen, no matter how careful the examination may be.

Finding many specimens in the course of a winter I racked my brains for a long time, trying to find out what they were. I had settled in my mind that they were dipterous, though I knew of

[1] This department is edited by Prof. C. V. Riley, Washington, D. C., to whom communications, books for notice, etc., should be sent.

no insect of that order having such habits. I thought of the gregarious habits of Sciara, and wondered if I had not found some new form which carried the larval custom on into the pupa state. My friends were equally puzzled with myself—none had ever seen such an object before.

One day I found that a number of small Chalcids had issued from one of the chains. This, however, did not shake my belief as I considered the Chalcids as simply parasites upon the original makers of the chain, and I waited with impatience for the real owner. However, more and more of the Chalcids issued, until at last every specimen I had collected, with the exception of those put away in alcohol, had excluded ten or a dozen of the parasites, and I had made up mind that I should have to wait till the next season before solving the problem, the idea never striking me that I had the solution right before my eyes.

The next spring I bred from a mine of *Gelechia pinifoliæ* Cham., a few specimens of a closely allied Chalcid and, upon opening the mine from which they had issued, I found one of the familiar chains, in which, however, the individual "puparia" seemed more fused together, and an examination with a Tolles ¼th showed a delicate membrane surrounding them all. This membrane the compound microscope showed to be the true skin of the Gelechia larva, but so stretched as to leave the sutures perfectly indistinguishable and to be recognizable only from the spiracles and anal hairs. Now going back to my oak chains I found, of course, the same to be the case; but the skin of the Lithocolletis larva had shrunken down into the crevices so tightly and its surface was so smooth that the resemblance to a string of puparia was perfect.

Later I had the opportunity of examining a larva of *Anarsia lineatella* Zeller, parasited by an allied species, and the same appearance resulted, greatly modified, however, by the larger size of the host and the greater thickness of its skin. I remember seeing somewhere a statement by Dr. Lintner, to the effect that he had bred a very interesting parasite from this Anarsia, and I hazard a guess that this was the species. I saw at once from this last larva that the appearance which had puzzled me so was after all only a modification of a phenomenon often met with in larger larvæ, the minute size of the Lithocolletis larva and the extreme delicacy of its last skin combining to produce the curious effect.

A somewhat similar appearance, caused by an allied parasite in the rather large larva of *Gelechia gallæ-solidaginis*, is described by Professor Riley in his First Missouri Report. He calls the parasite popularly "the Inflating Chalcis," and figures the parasited larva at Fig. 5, Plate 2.

Moreover, many attempts which were made last season to carry through the larva of *Plusia brassicæ* were frustrated by a congeneric parasite with similar habits. The Plusia larva, up to the time of commencing to spin, appeared quite healthy, although perhaps a

little sluggish. Then suddenly its torpor increased, and through the semi-transparent skin were seen hundreds of small white parasitic larvæ. In two days at the most the host was dead, having perhaps partially finished its cocoon, while its entire body was completely packed with the parasitic larvæ or pupæ, each surrounded by a cocoon-like cell. A cross section of the host at this stage showed a regular honeycombed structure. After remaining in the pupa state not longer than twenty days the Chalcids commenced to emerge by the hundreds. My friend, Mr. Pergande, took the trouble to count the parasites which actually issued from one Plusia larva, and, to our utter astonishment, the number reached 2528!

An interesting problem now presents itself as to the nature of the cocoon-like cell surrounding each Chalcid pupa in all these different hosts, from Lithocolletis up to Plusia. In the first place it is no silken cocoon, as is readily shown by the microscopic structure. Neither is it a membrane secreted from the general surface of the Chalcid's body, for but a single wall exists between two adjoining pupæ. For the same reason it is not the loosened last larval skin of the parasite. But one hypothesis remains, and that is that it is a morbid or adventitious tissue of the host, and this the histological structure of the cell-wall seems to show, as it is hyaline with a few simple connective tissue fibers running through it. Serious objections can also be brought up against this conclusion; but it is a point which it will be difficult to absolutely settle without closely watching the actual process of formation.

To return to our Lithocolletis parasite. I find the following note in Westwood, showing how even he was puzzled by what seems to have been a very similar object:

"De Geer has figured a minute black species with dirty white legs, which he reared from *minute cocoons* attached together side by side, found in the burrow of the larva of one of the pear leaf miners. *The figure has somewhat the air of an Encyrtus;* but the pupæ are naked in that genus. Can it be a Platygaster? or is it one of the Eulophides as the antennæ would seem to imply?" (Introduction, Vol. II, p. 170, foot-note.)

The italics are mine and the clause is emphasized from the fact that all the species to which I have referred above belong to the Encyrtid genus *Copidosoma*, of Ratzeburg, which, at the time Westwood wrote, was still included with Encyrtus. Westwood's mistake was in considering the cocoon-like objects as really cocoons, and this led him astray in his determination.—*L. O. Howard.*

New Insects Injurious to Agriculture.[1]—Almost every year the appearance of some insect or insects injurious to agriculture, but previously unknown in an injurious capacity, has to be re-

[1] Abstract of a paper read at the Cincinnati meeting of the A. A. A. S., by C. V Riley.

corded. The present year (1881) has afforded several striking examples, as *Crambus vulgivagellus*, which has seriously injured pastures, and *Phytonomus punctatus*, which has proved destructive to clover in the State of New York.

A new Pyralid has also very generally ravaged the corn plants in the Southern States. These new destructive species may either be (1), recently introduced species from some foreign country; (2), native species hitherto unobserved, or unrecorded, and new in the sense of not being described; (3), native species well known to entomologists, but not previously recorded as injurious.

The author argues that in the two last categories, more particularly, we frequently have to deal with newly acquired habits, and in the second category with newly acquired characters that in many cases systematists would consider of specific value. In short, he believes, that certain individuals of a species that has hitherto fed in obscurity on some wild plant may take to feeding on a cultivated plant, and with the change of habit undergo in the course of a few years sufficient change in character to be counted a new species. Increasing and spreading at the rapid rate which the prolificacy of most insects permits, the species finally becomes a pest and necessarily attracts the attention of the farmer. The presumption is that it could not at any previous time have done similar injury without attracting similar attention; in fact, that the habit is newly acquired. The author reasons that just as variation in plant life is often sudden, as in the "sport," and that new characters which may be perpetuated are thus created, so in insects there are comparatively sudden changes, which, under favoring conditions, are perpetuated. In this way characters which most systematists would consider as specific, originate within periods that are very brief compared to those which evolutionists believe to be necessary for the differentiation of specific forms among the higher animals.

New Entomological Periodicals.—We are in receipt of a circular from M. Constant Vanden Branden, Rue de la Madeleine, 69, Bruxelles, Belgium, announcing the monthly publication, beginning with February 1st, 1882, of a "Revue Coléoptérologique." This Review will be divided into five parts: I. Bibliography; II. New species described during the past month (latin diagnosis and precise reference); III. Synonymical remarks; IV. Necrology (if there be occasion for it); V. Sundry communications (sale of collections and books). Subscription price 10 francs for foreign countries. We have also received the prospectus of the *Wiener Entomologische Zeitung*, a journal to be devoted to general entomology, and to appear in 1882. It will be published "chez le libraire de la cour I. R. et de l'Université *Alfred Hölder*," and the editorial staff, which consists of Louis Ganglbauer, Francois Löw, Josèphe Mik, Edward Reitter and Franz Wachtl, is of a character to guarantee excellence. Price 8 marks. There is also a pros-

pect of a new entomological journal from Paris, under the auspices of "La Société Francaise d'Entomologie," a new society which is being talked of among certain members of the Société Entomologique de France who find the old society too slow for them.

Locust Probabilities for 1882.—In a letter from Missoula, Montana, written September 30th, Mr. Lawrence Bruner gave an encouraging report as to locust prospects. Starting from Ogden, Utah, he took the Utah and Northern railway to Melrose, Montana, laying off at various points along the Snake river, and in Southwestern Montana. From Melrose the route lay through the Valleys of the Big Hole, Deer Lodge and Hellgate rivers, all of which are noted as rich agricultural districts. From Missoula, Mr. Bruner went down the Missoula river to its junction with the Flathead river and thence on to the Spokane farming district. In reference to his observations in Montana, Mr. Bruner states: "So far I am led to believe there are no locust eggs east of the Rocky range this season. There were a few locusts in the Hellgate and Missoula valleys, also some in the valley of the Bitter Root. They left toward the west and north. A few eggs were deposited."

Entomological Notes.—Mr. C. A. Briggs gives in the October number of *The Entomologist* (London, Eng.) an illustrated account of a hermaphrodite hybrid between *Smerinthus ocellatus* and *Smerinthus populi*.

Mr. J. Jenner Wier of Blackheath, S. E., London, has recently studied some large collections of Lepidoptera made by Mr. E. G. Meek in the Outer Hebrides which consist chiefly of gneiss rocks and granite, and which are treeless and rather barren of other vegetation. Out of 56 species he was struck with the coloration in many which deviated from the normal coloring, especially among the Geometridæ which showed the gray color of the gneiss, having varied in the direction of the color of their environment.

Mr. V. R. Perkins records the capture of *Heliothis armigera* in Gloucestershire, Eng., and remarks on its sitting head-downwards.

ANTHROPOLOGY.[1]

Mr. Morgan's Last Work.—It seldom happens that a literary man lives to witness the completion of his labors. In the preface to Vol. IV., of the Contributions to North American Ethnology, upon the houses and house-life of the American aborigines, Mr. Morgan says: "As it will undoubtedly be my last work, I part with it under some solicitude; but submit it cheerfully to the indulgence of my readers." After the usual delay of printing, the volume made its appearance just in time to be placed in the author's hands upon his dying bed. "He feebly turned the pages, and as feebly murmured, 'my book.'" The New York *Nation*, of De-

[1] Edited by Professor Otis T. Mason, 1305 Q. street, N. W., Washington, D. C.

cember 22, and the Rochester *Democrat-Chronicle* of Dec. 18, contain brief sketches of the author's life and labors.

The work before us is not altogether new to students of anthropology, portions of it having appeared in Johnson's Cyclopedia, the *North American Review*, and the first volume published by the Archæological Institute of America. Nevertheless, there is here the added charm of maturer deliberation and a homogeneous plan. Mr. Morgan's whole conception of domestic life among our aborigines grew out of his theory of their social organization exhibited in the gens, the phratry, and the tribe. This is made manifest in the various chapters on the law of hospitality, communism in living, usages and customs respecting land and food, modern edifices, ancient structures, and even in those relating to the mound-builders.

The volume is profusely embellished and the illustrations are exceptionally fine. The NATURALIST is very hard to please in this respect, and in giving unqualified praise to Vol. IV., passes no empty compliment to the officers of the Bureau of Ethnology who have superintended the work.

THE CALENDAR STONE.—Mr. A. W. Butler, Secretary of the Brookville Society of Natural History, Ind., takes exception to Mr. Palmer's conclusions respecting the Calendar Stone. Mr. Butler spent several weeks in the city of Mexico and examined carefully not only the stone itself, but all the surroundings. The sides and upper surface of the stone are beautifully sculptured and the carving is as old as that upon any of the other great remains. Mr. Palmer has also misinterpreted the import of the sculptures. The idea of its having been a millstone is preposterous, all grinding having been done with the metate stones. Mr. Palmer also falls into another error respecting the beheading of victims, all authors agreeing that their hearts were cut out and offered to their idols. This may not be *the* "Sacrificial Stone," but all evidence points in this direction.

STONE IMAGE FOUND IN OHIO.—Some workmen, while excavating the foundation of a machine shop at Newark, Ohio, came upon an image of a bear, six inches in height, in a sitting posture. It is made of a soft material found plentifully in the locality. The left paw rests under the ear, the right paw on the abdomen. Projecting from under the chin is the face of a woman. Below the right paw is the inverted face of a man. Near the image was a human skeleton and a conch shell.

THE AMERICAN ANTIQUARIAN.—With the October number the *Antiquarian* enters on its fourth volume, and from the indications it is destined to live. Few persons know, however, what a great and unremunerative labor it is to sustain a periodical of this kind. The contents of the present number are as follows:

Gratacap, L. P.—Prehistoric man in Europe. (Contind. fr. III, No. 4.)
Brinton, Dr. Daniel G.—The probable nationality of the Mound-Builders.

Miller, O. D.—Dr. Brugsch-Bey on the origin of the Egyptians and Egyptian civilization.
Smith, Mrs. E. C.—Myths of the Iroquois.
Welch, Dr. L. B., and J. M. Richardson.—A description of Prehistoric relics found near Wilmington, Ohio.
Avery, Professor John.—Polyandry in India and Thibet.

The Correspondence, Editorial comments, Linguistic notes, and Recent Intelligence are by no means the least important part of the number. Dr. Brinton's article, to our taste, is the best contribution. A sentence or two will show the drift of the argument. "It would appear that the only resident Indians at the time of the discovery who showed any evidence of mound-building comparable to that found in the Ohio valley were the Chahta-Muskokee. I believe that the evidence is sufficient to justify us in accepting this race as the constructors of all those extensive mounds, terraces, platforms, artificial lakes, and circumvallations which are scattered over the Gulf States, Georgia and Florida."

CONTRIBUTIONS HERE AND THERE.—It seems to be an insuperable difficulty to have all anthropological articles of our country published in one journal. The next best thing is to have one periodical that shall act as a ledger in posting up all items for the student. This the NATURALIST fervently wishes to do, and in this note gives the titles of a few very important papers of this class.

Abbott, Dr. C. C. In the Proceedings of the Boston Society of Natural History, Vol. XXI, January 19, 1881, will be found an historical sketch of the discoveries of palæolithic implements in the valley of the Delaware river. Supplementary remarks by Mr. Henry W. Haynes, Mr. G. Frederick Wright, Mr. Lucien Carr, Dr. M. E. Wadsworth, and Professor F. W. Putnam are appended.

Putnam, Professor F. W. Were ancient copper implements hammered or moulded into shape? *Kansas City Rev.*, Dec. (The author holds that the aborigines did not cast copper.)

Ballou, Wm. Hosea. As scientific editor in *The American Field*, of Chicago, publishes quite frequently notes on anthropology.

The *Kansas City Review of Science and Industry.* The editor, Mr. Thos. S. Case, has done some good archæological work and never fails to give an original article and judicious selections with each number.

The Monthly Index to Current Periodical Literature, Proceedings of Learned Societies and Government Publications, issued from the office of the American Bookseller, 10 Spruce street, New York, is absolutely indispensable to every student who would keep himself posted upon what is doing in his peculiar field.

RECENT POPULAR WORKS.—We are called upon to mention the titles of two volumes recently issued not because they contain anything new upon scientific anthropology, but because they show how deeply seated in all thoughtful minds are those questions

which the anthropologist is daily busy with. I refer to Professor J. P. Lesley's "Man's Origin and Destiny sketched from the platform of Physical Sciences," published in Boston by George H. Ellis; and "The League of the Iroquois and other Legends, from the Indian Muse," issued by S. C. Griggs & Co. of Chicago. The former is the second edition of a course of lectures delivered before the Lowell Institute in the winter of 1865 and 1866. The work has long been before the public and has achieved a permanent success. The style is highly poetical, indeed it is at times painfully so. The burden of the argument is nowhere clearly stated, but the theme progresses by a series of surprises, a plan that is agreeable to the audience room, but not to the reader who wishes to digest. It is needless to state that Professor Lesley can tell us nothing new, either of man's origin or of his destiny.

Mr. Hathaway's poem is an attempt to give in a series of pictures the story of the origin of the Iroquois confederation and especially all that relates to Hayowentha. We hail with delight any and every attempt to preserve in prose or verse the sacred lore of our aborigines. The Bureau of Ethnology at Washington has during the past two years collected a hundred or more new myths, which will be published in the contributions to North American Ethnology.

ANTHROPOLOGY IN GREAT BRITAIN.—Trübner & Co. announce a work to be completed in ten volumes, entitled, "The Social History of the Races of Mankind." The IVth and concluding number of Volume X, of the Journal of the Anthropological Institute of Great Britain and Ireland gives us the following original papers.

Biddoe, Dr. John.—On anthropological colour phenomena in Belgium and elsewhere.

Rowbotham, —.—Certain reasons for believing that the art of music in prehistoric times passed through three distinct stages of development, each characterized by the invention of a new form of instrument, and that these stages invariably succeeded one another in the same order in various parts of the World.

Milne, John.—The Stone Age in Japan; with notes on Recent Geological changes which have taken place.

Tylor, E. B.—President's Annual Address.

Six pages of President Tylor's address are devoted to a very flattering review of Yarrow's "Mortuary Customs," and Col. Mallery's "Introduction to the study of the Sign Language among the North American Indians."

GEOLOGY AND PALÆONTOLOGY.

A NEW GENUS OF TILLODONTA.—An interesting new form of this sub-order has been found in the *Catathlæus* beds (probably the Puerco formation) of New Mexico. It differs widely from the two genera hitherto known, *Anchippodus* and *Tillotherium*. Owing to the absence of the superior dental series it is not possible to be sure which tooth is the canine. The inferior dental formula

may be therefore written, I. 2; C. 1; Pm. 3; M. 3; or I. 3; C. 0; Pm. 3; M. 3; or I. 3; C. 1; Pm. 2; M. 3. The first and second incisors are large and rodent-like, growing from persistent pulps; the second are the larger. The third, or canines, are small and probably not gliriform. There is no diastema. The first premolar (or canine) has a compressed crown with two cusps placed transversely to the jaw axis, and has a complete enamel sheath, and probably two roots. The succeeding tooth is also transverse, and is two-rooted, judging from the alveolus. The first and second true molars are rooted, and the crown consists of two transverse separated crests, each partially divided into two tubercles. On wearing, the grinding surface of each assumes the form of a letter B with the convexities anterior. The last inferior molar is injured. The rami are short, and the symphysis deep and recurved. This genus may be named *Psittacotherium.*

Psittacotherium multifragum, sp. nov.—The base of the coronoid process is opposite the junction of the second and third true molars. The ramus is deep and moderately stout. The enamel of the first incisor does not extend below the alveolar border, at the internal and external faces, and does not reach it at the sides. It has a few wrinkles on the anterior face. The anterior enamel face of the second incisor is thrown into shallow longitudinal grooves with more or less numerous irregularities from the low dividing ridges. There is a deeper groove on each side of the tooth, and there are about a dozen ridges between these on the anterior face. Both cusps of the first premolar are conic, and the external is the larger. The second true molar is a little smaller than the first. The enamel of the premolars and molars is smooth, and there are no cingula.

Probable length of dental series .0750; diameters of I. 1: anteroposterior .0120, transverse 0066; diameters I. 2: anteroposterior .0160, transverse .0115; diameters Pm. 1.: anteroposterior .0072, transverse, .0130; diameters of M. 11: anteroposterior .0090, transverse, .0090. Length of true molars .0038; depth of ramus at M. 11. .0360.

The short deep jaws of this animal must have given it a very peculiar appearance, not unlike that of a parrot in outline.—*E. D. Cope.*

A GREAT DEPOSIT OF MUD AND LAVA.—The Atlantic and Pacific R. R. traverses the Territory of New Mexico westward from the Rio Grande river, north of its center. For a great part of the distance between that river and the Arizona border, it passes over the plateau of the Sierra Madre, which chiefly consists in this region of mesas. The mountain ranges to the north are not in sight from the railroad, and those of the south are visible at a distance. The plateau is a large anticlinal one hundred miles in width, and consists of triassic and jurassic beds. The cretaceous

formations are seen highly inclined, resting upon both the eastern and western flanks. The railroad engineers have availed themselves of a line of drainage which cuts into the beds, forming a long valley extending east and west. Its water shed is about ten miles east of Fort Wingate, the streams on the one side flowing into the Atlantic, and on the other side into the Pacific oceans. They are called respectively the Puerco of the East and the Puerco of the West. Puerco means muddy, and the rivers are well named. The cliffs of jurrassic age on the north side of the valley are now a thousand feet in height near Fort Wingate, showing the enormous extent of the erosion. They consist everywhere of a soft red argillaceous arenaceous rock, and include a layer of gypsum. This material is readily eroded by atmospheric agencies, and is carried down into the valley during each rainy season in enormous quantities. The lower levels for a distance of one hundred and fifty miles E. and W., and from ten to twenty miles N. and S. consist of a vast deposit of mud. During the rainy season the streams are choked with it, and after the cessation of the rains, the borders of dried sheets of mud may be seen everywhere. Grass is buried up, but with many plants, in time, struggles through it. On the northern side of this valley, in the region of the extinct vent of San Mateo (Mt. Taylor), a lava sheet covers the older mud deposit. It displays exactly the characteristics of the cooled lava of late eruptions of Mount Vesuvius. It lies in innumerable ropes and coils, and forms like heavy drapery, as though it had cooled but yesterday. In cooling it has cracked into huge cakes. Water has percolated through the fissures, and has, in some localities, removed a large part of the supporting mud bed. Of course a portion of the mud is left beneath the middle part of the block, forming a fulcrum. With advancing erosion below, the lava block tips up, and stands obliquely on its edge. Tracts of this kind form most forbidding regions, and are absolutely impenetrable to any but small animals. Snakes appeared to be abundant in some localities passed by the train.—*E. D. Cope.*

Invertebrate Fossils from the Lake Valley district, New Mexico.—Mr. S. A. Miller, of Cincinnati, has identified the following fossils from the silver-bearing carboniferous limestone of Lake Valley, New Mexico:

Strophomena rhomboidalis, *Spirifera striata*, *S. novomehicana*, n. sp., *S. temeraria*, n. sp., *Athyris lamellosa*, *A. planosulcata*, *Orthis ruspinata*, *O. dalyana* n. sp., *O. michelini*, *Productus semireticulatus*, *P. vittatus*, *Rhynchonella pustulosa*, *R. tuta*, n. sp., *Platyceras oëquilatera*, *Prætus proceidens*, *Amplexus fragilis*, *Cyathophyllum subcæspitosum*, *Actinocrinus dalyanus*, n. sp., *A. copei*, n. sp., *A. lineatus*, n. sp., *Nautilus (Euomphalus) rockymontanus*, n. sp., *Camaraphoria occidentalis*, n. sp., *Trematopora americana*, n. sp: two undetermined species of *Bryozoa* of the family Fenestellidæ; two undetermined species of *Zaphrentis;* a fragment of *Ortho-*

ceras; two undetermined species of *Platycerinus;* three undetermined species of *Actinoceras.* Mr. Miller remarks that the age of the rocks, if all the fossils are from one range, is that of the Upper Burlington or Lower Keokuk, but if of different elevations, they represent these two groups respectively.

Some specimens are of interest as showing the nature of the process of deposit of silver in the limestone. A *Zaphrentis* and an *? Orthis* in good preservation, are partially replaced by argentiferous iron, which retains their structual details. This shows clearly that the process is one of replacement of the limestone by a fluid holding the metals in solution, and not by injection. This is also demonstrated by the undisturbed condition of the thin bedded limestone where traversed by veins of ore.—*E. D. Cope.*

Insects of the Amyzon Shales of Colorado.—In the Bulletin of the U. S. Geological Survey of the Territories of Hayden, Mr. Scudder publishes a review of the geology and palæontology of the above deposit. He observes: "The insects preserved in the Florissant basin are wonderfully numerous, this single locality having yielded in a single summer more than double the number of specimens which the famous localities at Oeningen, in Bavaria, furnished Heer in thirty years.

"The examination of the immense series of specimens found at Florissant has not gone far enough to yield data sufficiently definite for generalizations of any value, or which might not be altered, or even reversed, on further study. It may, nevertheless, be interesting to give a running note of what has been observed in assorting the collection, and to make the single comparison with the Oeningen insect fauna which the number of individuals will furnish.

"This is indicated by the following table, based on a rough count of the Florissant specimens, but which cannot be far astray.

Percentage of representation by	At Florissant.	At Oeningen.
Hymenoptera	40	14
Diptera	30	7
Coleoptera	13	48
Hemiptera	11	12
Neuroptera	5	17
Orthroptera	¼	3
Arachnida	¼	½
Myriapoda	1/25	
Lepidoptera	1/25	1/10
	99.58	101.6

"The plants, although less abundant than the insects, are exceedingly numerous, several thousand specimens having passed through the hands of Mr. Leo Lesquereux. Of these he has

published thirty-seven species in his Tertiary Flora, about two-fifths of which are considered identical with forms from the European Tertiaries. "We have in all from ninety to a hundred species of plants recognized from these Florissant beds, of which half the species belong to the apetalous exogens.

"The testimony of the few fishes to the climate of the time, is not unlike that of the plants, suggesting a climate, as Professor Cope informs me, like that at present found in latitude 35° in the United States; while the insects, from which, when they are completely studied, we may certainly draw more definite conclusions, appear from their general ensemble to prove a somewhat warmer climate. White ants are essentially a tropical family, only one or two out of eighty known species occurring north of latitude 40°. In North America only three have been recorded north of the border of the Gulf of Mexico, excepting on the Pacific coast, where one or two more extend as far as San Francisco. Two species, both belonging to the second section, are found in the valleys below Florissant, in 39° north latitude. Florissant itself is situated 2500 meters above the sea, and the presence of so considerable a number of white ants embedded in its shales, is indicative of a much warmer climate at the time of their entombment than the locality now enjoys. Investigation of other forms increases the weight of this evidence at every step, for nearly all the species (very few, certainly, as yet) which have been carefully studied, are found to be tropical or sub-tropical in nature. As, however, most of those studied have been selected for some striking feature, too much weight should not be given to this evidence."

This subject will be discussed in a forthcoming volume of the Report of the U. S. Geological Survey of the Territories of Dr. Hayden. The illustrations of this work which we have seen are of unusual excellence.

The Future of Geology.—Professor Ramsey, in his address before the British Association, said that in the British Islands the art of geological surveying has, he believed, been carried out in a more detailed manner than in any other country in Europe, a matter which has been rendered comparatively easy by the excellence of the Ordnance Survey maps both on the 1-inch and the 6-inch scales. When the whole country has been mapped geologically little will remain to be done in geological surveying, excepting corrections here and there, especially in the earliest published maps of the Southwest of England. Palæontological detail may, however, be carried to any extent, and much remains to be done in miscroscopic petrology which now deservedly occupies the attention of many skilled observers.

It is difficult to deal with the future of geology. Probably in many of the European formations more may be done in tracing the details of subformations. The same may be said of much of

North America, and for a long series of years a great deal must remain almost untouched in Asia, Africa, South America, and in the islands of the Pacific ocean. If, in the far future, the day should come when such work shall be undertaken, the process of doing so must necessarily be slow, partly for want of proper maps, and possibly in some regions partly for the want of trained geologists. Palæontologists must always have ample work in the discovery and description of new fossils, marine, fresh-water, and truly terrestial; and besides common stratigraphical geology, geologists have still an ample field before them in working out many of those physical problems which form the true basis of physical geography in every region of the earth. Of the history of the earth there is a long past, the early chapters of which seem to be lost forever, and we know little of the future except that it appears that "the stir of this dim spot which men call earth," as far as geology is concerned, shows "no sign of an end."

MINERALOGY.[1]

PHYTOCOLLITE, A NEW MINERAL FROM SCRANTON, PA.—This name has been given[2] to a very curious, jelly-like mineral recently found near the bottom of a peat bog at Scranton, Pa. An excavation for a new court-house had cut through a peat bog, below which was a deposit of glacial till. Near the bottom of the bog, in a carbonaceous mud, or "swamp muck," there occur irregular veins, of varying thickness and inclination filled with a black, homogeneous jelly-like substance, elastic to the touch. This substance becomes tougher on exposure to the air, and finally becomes as hard as coal. When thus dried, it is brittle, has a conchoidal fracture and brilliant lustre, and closely resembles jet. It is nearly insoluble in alcohol and ether, but is entirely soluble in caustic potash, forming a deep reddish-brown solution, from whence it can be again precipitated on the addition of an acid. It has a specific gravity of 1.032 and burns with a bright flame. After having been dried at 212°, it has the following composition, according to the analysis of J. M. Stinson:

		or without Ash	
C	28.989	C	30.971
H	5.172	H	5.526
N	2.456	O + N	63.503
O	56.983		100.
Ash	6.400		
	100.		

yielding the empirical formula $C_{10}\ H_{22}\ O_{16}$.

In its mode of occurrence and in general appearance, this substance closely resembles Dopplerite, but differs from that mineral

[1] Edited by Professor HENRY CARVILL LEWIS, Academy of Natural Sciences, Philadelphia, to whom communications, papers for review, etc., should be sent.

[2] H. C. Lewis, Proc. Amer. Philos. Soc., Dec. 2, 1881.

in burning with flame and in its composition. Another jelly-like substance from a Swiss peat bog, differing both from Dopplerite and from the Scranton mineral has been described by Diecke.

It is now proposed to group all these jelly-like minerals, produced by the decomposition of vegetable matter, under the one generic name of *Phytocollite* (φυτόν, κόλλα = "plant-jelly") of which the three minerals now known would be varieties.

Special interest is attached to these substances, in that they illustrate the first step in the transformation of peat into coal.

COSSYRITE.—Förstner[1] has given this name to a hornblendic mineral which abounds in the igneous rocks of the Lipari islands. It occurs in triclinic crystals closely approaching monoclinic forms. It has an easy cleavage in two directions, the included angle being 65° 51′. Spec. grav. 3.75. It has the following composition.

SiO^2	Fe^2O^3	Al^2O^3	FeO	MnO	CuO	CaO	MgO	Na^2O	K^2O
43.55	7.97	4.96	32.87	1.98	.39	2.01	.86	5.29	.33

Before the blowpipe it melts readily to a brownish-black glassy slag. It is partially decomposed by acids. It appears to be a variety of iron amphibole.

ALASKAITE.—A new sulphide of bismuth and lead from Alaska mine, Colorado, has been described by Dr. G. A. König.[2] It occurs as a pale lead-gray mineral of scaly structure and metallic lustre, which forms a more or less intimate mixture with quartz, barite, chalcopyrite, etc. It is soft, and has a spec. grav. of 6.878. In the closed tube it decrepitates and fuses. On charcoal gives characteristic coatings. It is soluble in sulphuric acid. It has the following composition:

Bi	Pb	Ag	Cu	Fe	Zn	S	Ba
51.35	17.51	3.	5.38	1.43	.20	17.85	2.83

The formula given is $(Pb, Zn, Ag_2, Cu_2)^{II}\ S + (Bi\ Sb)^{II}_2\ S^3$.

PSEUDOMORPHS OF COPPER AFTER ARAGONITE.—Domeyko has described some interesting cases of pseudomorphism of copper after aragonite observed in some Bolivian mines. He found hemitropic crystals of aragonite presenting all degrees of transformation into metallic copper, and showing every transition from crystals of pure aragonite to those of pure copper.

ELECTRICITY DEVELOPED BY THE COMPRESSION OF CRYSTALS.—Jacques and Curie[3] have shown that by the mere compression of an inclined hemihedral crystal, electricity is developed. They experimented by placing a crystal or a suitable section of it between two sheets of tinfoil insulated on the exterior by plates of

[1] Zeits. f. Kryst., v, 1881, p. 348.

[2] Zeits. f. Kryst., 1881, vi, 42.

[3] Bull. Soc. Min. de France, 1880, 93. Comp. Rend., 1881. iv, 186, and vii, 250.

caoutchouc, the tin foil being connected to a galvanometer. By now compressing the crystal in a vise or otherwise, electricity is developed and may be measured by the galvanometer. The electricity developed is the opposite of that produced by heating a crystal,—that is to say, the extremity of the crystal which becomes positive on heating, becomes negative on compression. On releasing the pressure, electricity of an opposite kind is produced. The authors find that the production of electricity by pressure can only be obtained with hemihedral crystals having inclined faces. By combining a number of such crystals in a pile, they have invented a new apparatus for producing electricity. The amount of electricity developed varies for different minerals. They find, for example, that a section of quartz, cut perpendicular to the main axis, evolves more electricity than a similar section of tourmaline.

NOTE ON GOLD.—There is a simple method for the detection of gold in quartz, pyrite, etc., which is not generally described in the mineralogical text-books. It is an adaptation of the well-known amalgamation process, and serves to detect very minute traces of gold.

Place the finely powdered and roasted mineral in a test tube, add water and a single drop of mercury; close the test tube with the thumb and shake thoroughly and for some time. Decant the water, add more and decant repeatedly, thus washing the drop of mercury until it is perfectly clean. The drop of mercury contains any gold that may have been present. It is therefore placed in a small porcelain capsule and heated until the mercury is volatilized and the residue of gold is left in the bottom of the capsule. This residue may be tested either by dissolving in aqua regia and obtaining the purple of Cassius with protochloride of tin, or by taking up with a fragment of moist filter paper, and then fusing to a globule on charcoal in the blowpipe flame.

It is being shown that gold is much more universally distributed than was formerly supposed. It has recently been found in Fulton and Saratoga counties, New York, where it occurs in pyrite. It has also been discovered in the gravel of Chester creek, at Lenni, Delaware county, Penna. In one of the Virginia gold mines wonderful richness is reported, $160,000 worth of pure gold having been taken from a space of three square feet.

A NEW TEXTBOOK OF MINERALOGY.—The mineralogists of Germany are fortunate in possessing a new and valuable work on mineralogy by Professor G. Tschermak. This work, the first volume of which has recently appeared, contains a full description of the physical, optical and crystallographic characters of minerals, and of the various delicate means of investigation at the command of modern mineralogists. Under the head of physical mineralogy an account is given of the latest discoveries

in elasticity and cohesion. Among the optical characters of minerals described are double refraction, phenomena of thin plates, interference figures, optic axial divergence and method of measurement, determination of the plane of polarization, circular polarization, pleochrism, theoretical explanation of the characters of uniaxial and biaxial crystals, etc.

It is to be hoped that this work may be translated into English for the benefit of the many students who feel the need of some such advanced textbook.

MINERALOGICAL NEWS. — It is stated that Mt. Mica, Maine, has been purchased by a mining company and is being worked for tourmaline, cassiterite and mica. This locality has yielded a large number of interesting minerals, and has been especially famous for its beautifully colored tourmalines.——*Monazite* has been found as minute tubular crystals, less than a millimeter in diameter, at Nil St. Vincent, near Brussels. It occurs in a crystalline schist associated with rutile, tourmaline and zircon.——The great beds of nitrate of soda which occur in the desert of Atacama, Chili, have been derived from the decomposition of underlying felspathic rocks.——*Vasite* is an altered orthite found near Stockholm.——It has been proved that the jade or nephrite of Siberia, like that of China, is a compact variety of tremolite.——An excellent method of separating from one another the minerals composing a rock, is to immerse the crushed rock in a very dense liquid of known specific gravity. The specific gravity of most of the minerals constituting rocks being between 2.2 and 3, it results that by preparing a liquid whose density may be made to vary between those limits, the minerals may be readily separated. Such a liquid is a solution of iodide of mercury in iodide of potassium. A solution of borotungstate of sodium may also be employed, the latter having a specifie gravity of about 3. ——*Native lead* has been found in Idaho.——*Fahlunite* occurs at McKinney's Quarry, Germantown, Penna.——*Vermiculite* occurs in Japan. It is in short six sided prisms of a brownish color. When thrown upon hot charcoal, it expands longitudinally to many times its original length, twisting and writhing like a serpent, and is shown to passing travelers as a local wonder. It is also used as a medicine. In many of its characters it is similar to the variety known as *Philadelphite*.——Out of 200 columns of *Basalt* from the Giants Causeway, recently measured, there were tetragons 3 per cent., pentagons 25 per cent., hexagons 50 per cent., heptagons 19 per cent., octagons 2 per cent.——Microscopic investigations have revealed frequent impurities in the *diamond.* Organic matter, carbon and bubbles of gas are common impurities. Quartz, chlorite, pyrite and hematite have recently been found inclosed in diamonds. Small crystals of topaz have also been seen within diamonds.——Cossa has shown that all *apatite* contains phosphate of cerium, lanthanum and didymium united with phosphate of

lime, and that there is no such mineral as cryptolite. The rare earths were recognized by means of spectral analysis and are present in all apatite. Their presence in the Canadian apatite has also been proved by chemical analysis.

GEOGRAPHY AND TRAVELS.[1]

THE JEANNETTE AND THE SEARCH EXPEDITIONS.—A portion of the crew of the *Jeannette* arrived in two boats at the mouth of the Lena about the 17th of September last. They report that their vessel was crushed in the ice on June 23, 1881, in N. lat. 77° 15′ E. long. 157°, about one hundred and fifty miles northeast of the New Siberian Islands. It appears that the *Jeannette* was caught in the pack on October 1, 1879, and drifted with the winds and currents up to the time she was abandoned.

From the Report of Captain C. L. Hooper we learn that the U. S. revenue steamer *Corwin*[2] sailed from St. Michaels on July 9th 1881. She reached Herald Island on July 30th, and, a landing being effected, a thorough exploration of the island was made. The cliffs which render it almost inaccessible are about 1200 feet high. After much difficulty with the ice Capt. Hooper succeeded in reaching Wrangell Land, off the mouth of a river. The landing was made at about the locality where the supposed Plover Island has generally been designated on the maps and is in latitude 71° 4′ N. and longitude 177° 40′ W. and is the most eastern part of Wrangell Land. It is forty-five miles from Herald Island and in clear weather is in plain sight from it. Wrangell Land was taken possession of in the name of the United States and re-named "New Columbia." No snow was found in the lowlands or hills though remains of very heavy drifts were observed on the distant mountains. The river was named Clark; it was seventy-five yards broad and twelve feet deep. The party proceeded four miles inland and from a high hill traced the course of the river northwards for about forty miles. Over twenty species of Arctic plants were found in bloom. Capt. Hooper believes that the sea between Herald Island and Wrangell Land is almost always closed; the water is shallow and solid ice appears to remain constantly frozen to the bottom. The *Corwin* next visited Point Barrow which was found to be clear of ice. She arrived at Plover Bay on August 4th, finding the *Golden Fleece* there. After an unsuccessful attempt to revisit Herald Island and Wrangell Land the *Corwin* left the Arctic Sea on September 14th, and reached San Francisco on the 22d of October.

The U. S. steamer *Rodgers* reached Plover Bay about August 14th and arrived at Herald Island on August 24th, where a landing was made. The south coast of Wrangell Land was reached after passing throught about twelve miles of loose ice on

[1] Edited by ELLIS H. YARNALL, Philadelphia.
[2] The name of this vessel is *Corwin* not Thomas Corwin.

August 25th. The next day a good harbor was found and exploring parties were sent out to examine the interior and the coast line. A mountain about 2500 feet high was ascended. Open water was seen in all directions except between the west and south-south-west, in which quarter a high range of mountains seemed to terminate the land. Two parties were sent out in boats, of which one followed the eastern and the northern shores until stopped by ice when the boat had to be abandoned and a return made on the land, while the other boat took the western shore along which it passed until stopped by the same ice, after passing the most northern point of Wrangell Land, where the position of the other party could be seen. Wrangell Land is thus shown to be an island about sixty miles in length. At the northern end there is a current running to the north-west at about six knots an hour. The *Rodgers* anchorage was in N. lat. 70° 57′ W. long. 178° 10′. It is situated to the south and west of Capt. Hooper's landing place at the mouth of Clark River. The *Rodgers* afterwards reached N. lat. 73° 44′ W. long. 171° 48′ on September 19th. She expected to winter in St. Lawrence Bay.

The U. S. steamer *Alliance* reached lat. 79° 36′, in the neighborhood of Spitzbergen, in September last. Captain Wadleigh found the ice extending far to the eastward and southward of the ordinary limit, and it was also much heavier. The Norwegian walrus hunters, who ordinarily go to Hinlopen Straits and even further on the north coast of Spitzbergen, did not this season get as far to the north and east as the *Alliance*. Wyde Jan's Water on the south-east was full of ice, which extended from Hope Island nearly to Cape Petermann, Novaya Zemlya. Captain Wadleigh says that the southerly position of the ice is accounted for by the last very severe winter, and the fact that during July and August the usual southerly winds did not prevail and force the ice northwards. Captain David Gray confirms this report in a letter given in the Royal Geographical Society's Proceedings, in which he states that the ice for the past two years has been almost stationary, notwithstanding that strong northerly winds prevailed. "The absence," he writes, "of southerly drift can only be accounted for by the lanes of water making amongst the floes being immediately frozen up again with the severe frosts, keeping the ice fixed together, and preventing any large waters being made to force the ice south. The ice has not diminished during the last two summers so fast as usual owing to the frosts covering the lanes and pools of water with bay ice, preventing the wash of the water from cutting into it and washing it away. Close ice melts very slowly; open ice soon disappears."

The Lady Franklin Bay Expedition made the most rapid passage through Melville Bay ever recorded and reached their destination one month after leaving St. John's, N. F. They stopped to take aboard natives, furs and dogs at Godhaven, Rittenbank,

Uppernavik and Proven. Dr. O. Pavy joined the company at Godhaven. They sailed from Uppernavik through the middle passage to Cape York in thirty-six hours, and, though delayed by a fog for thirty-two hours, were only six days and two hours in reaching Lady Franklin Bay. They stopped at Cary Island and visited the depot of provisions placed there by Captain Nares in 1875. They also visited Littleton Island, where they found the English Arctic mail, left by the *Pandora* in 1876; and the *Polaris* quarters at Life-boat Cove, where they discovered many relics, including the transit instrument belonging to that unfortunate company. They also stopped at Washington Irving Island and Cape Hawks to inspect depots established by Nares, and landed supplies at Carl Ritter Bay. No heavy ice was met until inside of Cape Lieber, eight miles from their destination. They entered Discovery Harbor on August 11th, and when the *Proteus* left Lieutenant Greely had got the house erected and partly framed and three months' rations of musk cattle secured. About 140 tons of coal were landed from the *Proteus*. The *Proteus* reached St. John's on her return voyage on September 19th.

The Point Barrow party also safely reached their station early in September. The *Golden Fleece* returned to San Francisco on November 5th. The station is five miles from Point Barrow and is called Ooglalamie. The observatory was completed when the *Golden Fleece* left on September 17th and the main building begun. Early in the spring Lieut. Ray hopes to explore the valley of the Coppermine and afterwards visit Kotzebue Sound where a vessel is to be sent with supplies.

Arctic Exploration.—In a paper read by Professor George Davidson before the Geographical Society of the Pacific, Plover Island was described as a low pyramidal rock extending as a cape from the east end of Wrangell Land and connected by a low neck of swampy land covered with grass.

The Russian expedition to the mouth of the Lena, to establish one of the stations agreed upon by the International Polar Conference, will go by rail to Nishni Novgorod, thence by sleigh to Perm, by rail to Yekaterineburg, by sleigh to Irkutsk where they are expected to arrive in January and stay until May, to complete their preparations. They will descend the Lena on a barge. Owing to a lack of funds the second Russian station in Novaya Zemlya will not be established at present.

In a recent work "Die Temperatur Verhältnisse des Russischen Reichs" by Professor Wild of St. Petersburg, the Siberian pole of cold in winter is transferred from the neighborhood of Yakutsk to a point somewhat further north, lying in the Arctic circle about E. long. 125°. At this center of maximum cold round which the isotherms lie in fairly regular ovals, the mean temperature in January sinks as low as—54° F., the mean temperature at Yakutsk being 11° higher.

The *Athenæum* states that "Captain J. W. Fisher, of the American whaler *Legal Tender*, reached San Francisco at the end of September from Point Barrow, and he reports that in August the ice barrier was over twenty miles north of the point, and was every day moving further northward. The steam whaler *Belvidere* had gone much further to the east than the rest of the whaling fleet in an endeavour to reach the Mackenzie River, about 450 miles east of Point Barrow. On her outward voyage the *Legal Tender* had on board Drs. Arthur and Aurel Krause, who had been sent out by the Bremen Geographical Society to undertake a journey in the coast districts and islands of Behring Strait and Sea, partly for the purpose of investigating the ethnology and marine zoölogy of Alaska. Capt. Fisher landed them at St. Lawrence Bay where they were to spend a fortnight, and then proceed to East Cape and the Diomede Islands. On returning to St. Lawrence Bay they proposed to work their way down the Siberian coast to Plover Bay. Capt. Fisher states that Mr. W. H. Dall, of the U. S. Coast Survey, has made a great mistake in his reports respecting the current in Bering Strait. During the whole summer a strong current sets northward through the strait and it is only in September or October that northerly winds affect it. Mr. Dall's observations, he says, extended only over a few days and were made in an eddy current under the lee of the Diomede Islands. Capt. Fisher further reports that off Point Barrow a current of three or four knots an hour sets regularly along the land to the north-east, but it does not extend for fifty miles off the shore."

Geographical Notes.—A committee of the Royal Society consisting of Sir George Airy, Professor J. Adams and Professor Stokes, appointed to consider what "might yet be required in order to render the pendulum operations, which have been carried out in connection with the great trigonometrical survey of India, reasonably complete as an important contribution towards the determination of gravity all over the earth," have reported that it is desirable that "the Indian group of stations, which have already been connected with Kew, should be differentially connected with at least one chain of stations which are so connected with one another, and which have been employed in the determination of the figure of the earth." They refer to the suggestion made by Professor Peirce of the U. S. Coast Survey, that the same two pendulums that were swung in India should be used first at Kew and then at Washington. They say—"As Washington is, or shortly will be, connected differentially with a large chain of stations widely distributed in America and elsewhere, we think that the value of the Indian series would be decidedly increased by being connected with one of the American stations, such as Washington."——It appears that as early as the sixteenth century plans had been formed by the Spanish for canals in Central

America between the two seas. A canal via the lake of Nicaragua was projected in 1548. Other explorations were made, for this purpose, in the Isthmus of Tehauntepec and the Isthmus of Panama.——M. Alphonse Milne Edwards has recently been making investigations in the waters of the Mediterranean. During the seventy days he was so engaged the greatest depth reached by sounding and dredging was 2600 metres. The bottom was found not devoid of living beings, species of low organization being found between depths of 1068 and 2600 metres. At an average depth of 250 metres the temperature was constant at 13° Cent. This explains the small development of life in the depths of that sea, the muddy bottom and the absence of rocks being also unfavorable to germination. The report also confirms the belief that the Mediterranean is a sea of recent formation.——The English missionary Mr. Pearson has recently returned home from Uganda with a large amount of information concerning the country and the Victoria Nyanza. He has surveyed the western shore of the lake, taken many observations, and left a careful meteorological journal. He speaks highly of the general accuracy of Mr. Stanley's work and found that nearly all his latitudes were correct. ——The reinforcement of laborers for Mr. Stanley, numbering 135, left Zanzibar for the Congo on October 20th. The Belgian Association has abandoned its proposed expedition to Nyangwe which was to have effected a junction with Mr. Stanley on the lower Congo.——*Petermann's Mittheilungen* for November last contains a valuable paper by Ernest Marno on the Grass Barriers of the Nile.

MICROSCOPY.[1]

A Hollow Glass Sphere as a Condenser for Microscopic Illumination.—A glass globe filled with water has long been employed by watchmakers and engravers for the purpose of condensing the light upon their work; it was also used by some of the early microscopists. Ledermüller, in his "Mikroskopische Gemüth-und-Augen-Ergözung" (Microscopic Mind-and-eye-delights) 1763, gives a representation of his lamp and condenser; the latter is a globe without foot or neck, and is supported on the top of a square brass rod by six claws, the lamp being supported in the same way, both of them sliding into square holes at the opposite ends of a brass arm fixed on a stand. In the "Micrographia," Hooke gives a figure of his microscope and accessories, amongst them is a globe condensing the light on the stage of the instrument. This form of condenser was probably used by many of the old microscopists, but it appears soon to have fallen into disuse, as it is not mentioned by Adams in his "Micrographia Illustrata," 1771, or in his "Essays on the Microscope," 1787. Possibly the opticians of the period did not care to introduce so

[1] This department is edited by Dr. R. H. Ward, Troy, N. Y.

simple and inexpensive a contrivance to their patrons (mine cost one and eightpence).

I had looked upon the "globe condenser" as one of the relics of the past, and not worthy of resuscitation, until a short time ago when watching an artist engraving some fine shading on wood. I was struck with the sharpness and definition of the engraved lines (about $\frac{1}{80}$ inch apart). It at once occurred to me that this kind of illumination would suit the microscope. I therefore borrowed it and tried it first with a ¼ objective (a Ross 75°) upon *Pleurosigma angulatum*, using oblique light from the mirror; the striæ came out very distinctly. I then removed the globe, and the striæ vanished and required a more oblique ray to render them again visible. I next tried it on *Synedra robusta*, and resolved the striæ into beads; this I had not been able to do before with this objective. I next tried it with low powers (1½ in., 1 in. and ⅔ objectives). I first used the ⅔, but forgot to alter the previous position of the mirror, and consequently obtained a "black field;" the object I had placed upon the stage was *Haliomma humboldtii;* I was surprised at the beautiful effect upon that form. It appeared as though illuminated by intense moonlight with a slight green tinge, and delightfully cool to the eye. I have since purchased a smaller globe (six inches in diameter) than the one I tried; the liquid with which it is filled is a dilute solution of sulphate of copper (about ½ ounce of saturated solution to one pint of water). The mixture must be filtered if ordinary water is used, the intensity of color is, however, somewhat a matter of taste. The distance of the globe from the lamp should be about two or three inches; from the globe to the mirror about eight to twelve inches. As the height of the globe cannot be altered, the necessary adjustments must be made with the lamp, *e. g.*, if the mirror is at A, the lamp flame must be at C; if at C, the flame must be at A. I have just received a letter from a friend to whom I recommended the illumination, in which he writes: "I am delighted with the black ground illumination, which is certainly softer and the definition sharper than any I have tried before. Have you tried it with polarized light? I think you would be pleased with it, there is such great softness of tint and such impenetrable blackness of field when the prisms are crossed.—*F. Kitton in Science Gossip.*

C C
B B
A A

Arrestation of Infusorial Life.—Three years ago I brought with me to the Alps a number of flasks charged with animal and vegetable infusions. The flasks had been boiled from three to five minutes in London, and hermetically sealed during ebullition. Two years ago I had sent to me to Switzerland a batch of similar flasks containing other infusions. On my arrival here this year 120 of these flasks lay upon the shelves in my little library. Though eminently putrescible, the animal and vegetable

juices had remained as sweet and clear as when they were prepared in London. * * * * I took advantage of the clear weather this year to investigate the action of solar light on the development of life in these infusions, being prompted thereto by the interesting observations brought before the Royal Society by Dr. Downs and Mr. Blunt, in 1877. The sealed ends of the flasks being broken off, they were infected in part by the water of an adjacent brook, and in part by an infusion well charged with organisms. Hung up in rows upon a board, half of the flasks of each row were securely shaded from the sun, the other half being exposed to the light. In some cases, moreover, flasks were placed in a darkened room within the house, while their companions were exposed in the sunshine outside. The clear result of these experiments, of which a considerable number is made, is that by some constituent or constituents of the solar radiation an influence is exercised inimical to the development of the lowest infusoria. Twenty-four hours usually sufficed to cause the shaded flasks to pass from clearness to turbidity, while thrice this time left the exposed ones without sensible damage to their transparency. This result is not due to mere differences of temperature between the infusions. On many occasions the temperature of the exposed flasks was far more favorable to the development of life than that of the shaded ones. The energy which in the cases here referred to prevented putrefaction was energy in the radiant form. In no case have I found the flasks sterilized by insolation, for, on removing the exposed ones from the open air to a warm kitchen, they infallibly changed from clearness to turbidity. Four-and-twenty hours were in most cases sufficient to produce this change. Life is, therefore, prevented from developing itself in the infusions as long as they are exposed to the solar light, and the paralysis thus produced enables them to pass through the night time without alteration. It is, however, a suspension, not a destruction, of the germinal power, for, as before stated, when placed in a warm room, life was invariably developed. * * * It would also be interesting to examine how far insolation may be employed in the preservation of meat from putrefaction.—*Professor Tyndall before British Association, 1881.*

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SCIENTIFIC NEWS.

— The Annual Report of the Chief Signal Officer for 1881, show that this Bureau was never in more efficient order, nor doing more to promote scientific as well as purely practical interests. For example Gen. Hazen reports that he has endeavored to bring this service into active sympathy and coöperation with the ablest scientific intellects of the country. "In this direction and in response to my request, the Natural Academy of Sciences has appointed an advisory committee of consulting specialists

with which I may confer as occasion demands. I take pleasure in acknowledging this courtesy as showing the establishment of more intimate relations between the scientific interests of the United States and the Signal Service."

A Scientific and Study Division, was established January 27, 1881, for the purpose of scientific research and investigation into the laws of meteorology. Connected with this division are consulting specialists, who are employed as occasion may require. To this division also are referred all questions relating to standard measurements, altitudes of signal stations, and the preparation of tables for the reduction and the conversion of meteorological observations.

During the past year stations of observation on the habits and ravages of the Rocky Mountain locusts or grasshoppers, were established in those sections that the experience of past years has shown to be most exposed to the ravages of these pests. These stations were at Omaha, Grand Island, North Platte, and Sidney, Nebr.; Cheyenne, W. T.; Denver, Colorado Springs, and Pueblo, Col.; Ft. Sill, Ind. T.; Ft. Elliott and all other stations on the United States military telegraph lines in northern, central and southern Texas, and those on the Northwestern military telegraph line in Dakota, and Montana. Where civilians were employed in making the observations, their services were voluntary and without compensation, the government bearing the necessary expenses for stationery and telegraphing.

It is gratifying to state that not a single report of the ravages of locusts has reached this office, and their presence has been announced only at Grand Island, Nebr.; Ft. Supply, Ind. T., and Ft. Elliott, Texas, but in no instance has any danger been reported.

— In continuance of the biological explorations made by the U. S. Coast and Geodetic Survey, M. Alexander Agassiz spent portions of last March and April at the Tortugas and Key West. On the days when the weather was not favorable for work in collecting surface animals, Mr. Agassiz cruised among the reefs and examined carefully the topography of the different groups of corals characteristic of the Florida reefs, with reference to the light they threw on the share the different species of coral have in the formation of the reef, and he has collected data from which he expects to construct a map, showing the position of the different species of corals within the area occupied by the reef-builders of the Tortugas. It was found that the members of the surface fauna of the Atlantic coast are inhabitants of the surface of the Gulf stream, which are driven on the northern shores by the prevailing southwesterly winds during the summer and autumn months. Much of this surface work during March and April reminded him of similar work done at Newport from the end of July until late in September; but, of course, the number of specimens was far greater at the Tortugas. The surface fauna of the Gulf

stream can undoubtedly be best studied at the Tortugas, though important additions to our knowledge of it have been made at Charleston, S. C., and at Beaufort, N. C., and along the coast of New Jersey, of Rhode Island, and of Southern Massachusetts. It is remarkable that the beautiful purple floating shell (Janthina), which is so common at the Tortugas, should not find its way further north than off Cape Hatteras, in common with other surface forms. There are also found at the Tortugas a large number of pelagic crustaceæ in their larval stages, among them Phyllosoma and the nauplius stage of a Peneus, similar to that observed by Fritz Müller; also multitudes of young Annelids, Molluscs, Actiniæ, the planulæ of several of the corals, Echinoderm embryos, and a host of young pelagic fishes, among which he mentions the young of the flying fish and Leptocephali. For the study of the young stages of fishes and of Acalephs the Florida reefs present an unrivaled field of observation, but the number of pelagic Foraminifera was unexpectedly small.

— A work on the Gymnotus, or electric eel, was presented to the Paris Academy the other day by M. Du Bois-Reymond. It gives the results of recent researches in Venezuela by Dr. Sachs, who went out some five years ago, at the suggestion of the Berlin physiologist, to study the creature in its habitat. Dr. Sachs had not completed the working up of his material for publication when, unhappily, he lost his life on a glacier in the Tyrol, in 1878. His work has been extended by M. Fritsch, with the aid of numerous specimens and preparations of the fish brought home. Among other things, M. Fritsch has succeeded in proving, with all but certainty, the development of the electric organs from striated muscles by metamorphosis. Various obscure points have been elucidated.

— Mr. Alfred G. Lock, F. R. G. S., of 16 Charing Cross, London, England, is preparing a book on gold mining, in which he desires to describe every process and every machine of recognized value in use, both in alluvial and quartz mining. He wishes also to treat fully of the mineralogical associations and geographical occurrence of gold in all parts of the world, and to give maps showing the geographical position of all the gold fields known to exist, the strike of the reefs and the rivers whose lands are known to be gold bearing. The United States being the greatest gold producer and its gold saving machinery being the most elaborate, he desires to give it the prominent position in the book which its importance demands. He desires therefore to procure all papers, reports, photographs, or other illustrations of the subject. In all cases the sources of his information will be fully acknowledged.

— The Providence Lithograph Company are about to publish the Chautauqua Scientific Diagrams. Series No. 1, *Geology*, to be edited by Professor A. S. Packard, Jr. Price $6. The series will consist of ten chromo-lithographic charts, 33 × 23 inches. The sub-

jects are mostly restorations of Silurian, Devonian, Carboniferous, Mesozoic, Tertiary and Quaternary fossil plants and animals. While the series is designed for popular audiences, they will be found useful in colleges and high schools.

— Edward Wethered, F. G. S., of Hillylands, Weston Park, Bath, England, has become sub-editor of the *Geological Record*, for America, and he asks the coöperation of all geologists by sending to his address all pamphlets or reports, connected directly or indirectly with the geology of this country. His connections will commence with the volume for 1879, and he says that a great effort will be made to bring it up to the present time.

— Dr. John W. Draper, the eminent scientist, and author of Human Physiology, a History of the Intellectual Development of Europe, the History of the Conflict between Religion and Science, numerous memoirs on chemical and physical subjects, and a History of the American Civil War, died at Hastings-on-the-Hudson, Jan. 4, aged 71. He was born in England, May 5, 1811.

— Professor Arch. Geikie, Director of the Geological Survey of Scotland, has just been appointed Director-General of the whole of the Geological Survey of Great Britain, and also Director of the Geological Museum, Jermyn street, London. He will therefore resign his professorship in the University of Edinburgh and make his residence in London.

— Dr. Chr. G. A. Giebel, an eminent geologist and author of a work on bird-lice and other insects, died at Halle, Nov. 14. Professor P. G. Lorentz, a well known German botanist, author of a work on mosses, died at Concepcion, in Uraguay, aged 46.

— Robert Mallet, whose researches on earthquakes have made his name well known, died in London, Nov. 5, aged 71. His Earthquake Catalogue was completed, says *Nature*, with the aid of his son, now Professor J. W. Mallet, of Virginia.

— Professor J. E. Hilgard, after a term of service of thirty-four years as assistant, has been appointed Superintendent of the U. S. Coast and Geodetic Survey; a most fitting appointment.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

California Academy of Sciences, Nov. 4.—The announcement of the generous gift of $20,000 by Charles Crocker, Esq., recorded in the December Naturalist, was made.

A paper by Professor Davidson, on the Transit of Mercury, accompanied with drawings, was then read, and Dr. Robert E. C. Stearns read a paper on "The Botanical Relations of *Physianthus albens*: the structure of its flowers and their peculiarities as an insect trap." He referred to this plant as related to groups which possess various important economical characters, furnishing peculiarly fertile fields for investigators of pharmaceutical and organic chemistry. Dr. Stearns then exhibited many beautiful specimens of these flowers, each one of which had entrapped an

insect or moth of some kind, which it held firmly by the proboscis. They are found in many gardens adjoining San Francisco, are hardy and of rapid growth, having a white, sweet-scented flower suitable for ornamental purposes. It came originally from Buenos Ayres and is popularly called a moth-trap. It is a species of milk-weed. This plant belongs to a group which is related to the ornamental phloxes, the parasitic dodders, one form of which is destructive to our alfalfa, as it winds its fatal thread and strangles the plant by preventing the upward flow of the sap. The bind-weeds are popularly known by the sweet potato, also by jalap, scammony and other medicinal plants. Other related groups include tobacco, mandrake, potatoes, and egg-plant; also the olive, the common lilac and flowering ash. In all plants of this group the sap is milky, acrid and bitter; also contains more or less caoutchouc. The roots are diaphoretic, emetic or cathartic. The inner bark yields very strong and fine fiber. One form is known in Ceylon as the cow plant, and yields a palatable sap, which is used by Cingalese as milk. It is supposed that these plants are fertilized by insects, and the insects are caught by their probosces, between the wings of the anthers while seeking for the nectar. Other insects, such as ants, beetles, etc., are often found in the nectary of these flowers, but not as prisoners. The paper was elaborately illustrated by blackboard drawings.

Dr. Behr and Dr. Gibbons then spoke in further explanation of insect traps, and Dr. Behr read a paper on "The Part Played by Hawk Moths in the Economy of Nature."

Dr. Arthur Krause and Mr. Aurelius Krause, of the Bremen Geographical Society, who have just returned from explorations in Siberia, were present and promised to address the Academy at a future meeting.

Mr. Dieckmann, of Nicolaeskfy, Amoor river, an entomologist, said tigers were very plenty on the shores of the Okhotsk sea, and were found throughout Siberia with white bears. They have hair five inches long, and are larger than Himalayan tigers. They prey on large herds of reindeer, and remain far north all winter, where snow is four feet deep, never migrating far south. They also eat wild boars. Natives believe the bear to be influenced by the Good God, and tigers by the Evil Spirit. Five natives frequently lasso and catch bears alive, but always kill the tigers. He then described the native ceremonies at a bear feast, some of which were quite laughable.

The matter of some lectures on islands of the South Pacific, by Captain Augustus E. Bruno, was referred to the Council for action, many members desiring to hear from Captain Bruno before his departure East, to lecture before the Peabody Institute, Boston Society of Natural History and other scientific societies.

Mr. Brooks then made some remarks, giving the late news from the *Rodgers*, and illustrated her track with an outline of the Coast of Wrangell Island.

NEW YORK ACADEMY OF SCIENCES, Dec. 12.—The following papers were read: Additional notes on the geology of Staten Island, by Mr. N. L. Britton. Remarks on the Mammoth cave of Kentucky, by Mr. W. Le Conte Stevens.

Dec. 19.—The following papers were read: On a peculiar coal-like transformation of peat, recently discovered at Scranton, Penn., by Professor H. L. Fairchild. On the means of giving accuracy to ventilation by steam, by Professor W. P. Trowbridge.

BOSTON SOCIETY OF NATURAL HISTORY, Dec. 21, 1881.—Mr. John A. Jeffries spoke on the spurs and claws of birds' wings, and Mr. S. H. Scudder on Tertiary fossil spiders, especially those of Florissant.

Jan. 4, 1882.—Professor E. S. Morse compared the shells of New England Kjökkenmöddings with the present forms of the same species, and Miss M. H. Hinckley showed some structural differences between our native tadpoles and their bearing on the classification of the species.

AMERICAN GEOGRAPHICAL SOCIETY, Dec. 21.—Mr. W. E. Griffis lectured on Corea, the hermit nation.

Jan. 10.—Mr. T. By. Myers read a paper entitled, Our acquisition of French territory west of the Mississippi, in 1803.

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SELECTED ARTICLES IN SCIENTIFIC SERIALS.

BULLETIN OF THE U. S. GEOLOGICAL AND GEOGRAPHICAL SURVEY OF THE TERRITORIES, Vol. VI, No. 2, Sept. 19, 1881.—Annotated list of the birds of Nevada, by W. J. Hoffman. North American moths, with a preliminary catalogue of species of Hadena and Polia, by A. R. Grote. The Tertiary lake basin of Florissant, Colorado, by S. H. Scudder. Revision of the genus Sciurus, by E. L. Trouessart. Osteology of the North American Tetraonidæ, by R. W. Shufeldt. Osteology of *Lanius ludovicianus excubitorides*, by R. W. Shufeldt. Review of the Rodentia of the Miocene period of North America, by E. D. Cope. On the Canidæ of the Loup Fork Epoch, by E. D. Cope. On a crayfish from the Lower Tertiary beds of Western Wyoming, by A. S. Packard, Jr.

AMERICAN JOURNAL OF SCIENCE, Jan., 1882.—Contributions to meteorology: mean annual rainfall for different countries of the globe, by Elias Loomis (map). Post-glacial joints, by G. K. Gilbert. The connection between the Cretaceous and the recent Echinid faunæ, by A. Agassiz. Classification of the Dinosauria, by O. C. Marsh.

GEOLOGICAL MAGAZINE, Dec., 1881.—Contributions to fossil Crustacea, by H. Woodward.

JENAISCHE ZEITSCHRIFT FÜR NATURWISSENSCHAFT, Nov. 25.—Free-cell formation in the embryo-sack of Angiosperms, by F. Soltwedel. On the so-called compass-plant, by E. Stahl. Sketch of a system of Radiolaria based on a study of the *Challenger* Radiolaria, by E. Haeckel.

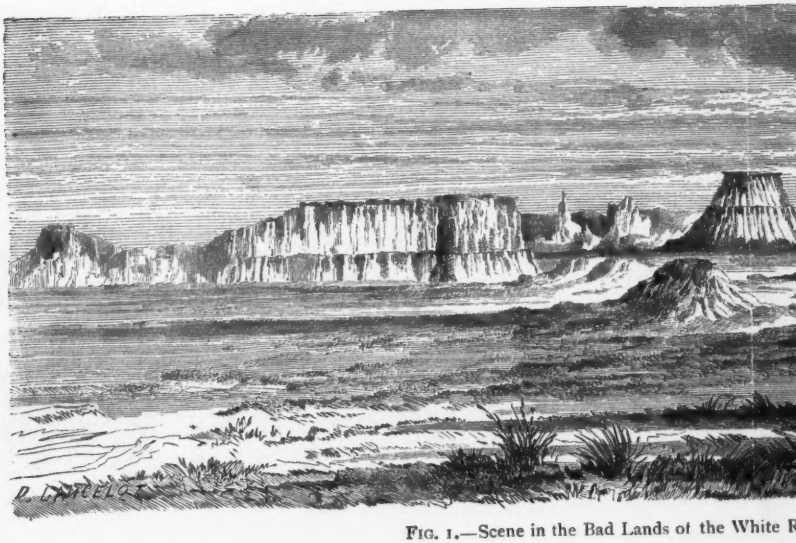
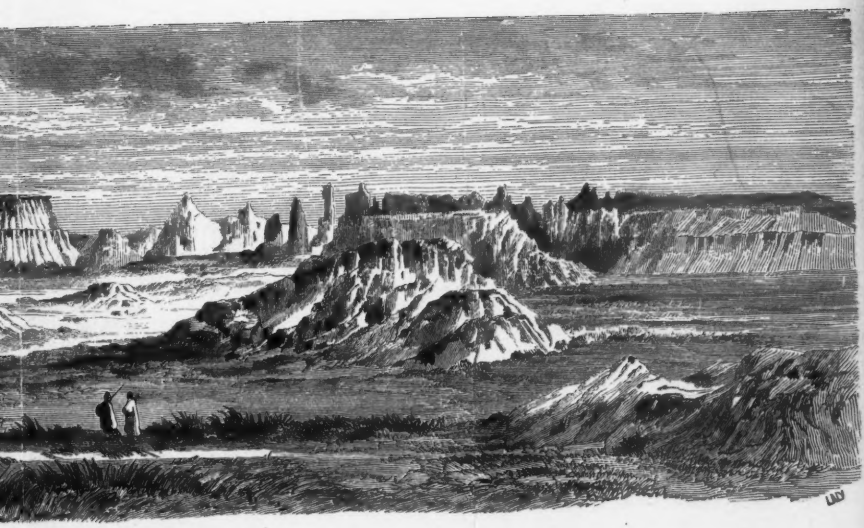


FIG. 1.—Scene in the Bad Lands of the White R



White River formation in Nebraska. From Dr. Hayden.

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THE TERTIARY FORMATIONS OF THE CENTRAL REGION OF THE UNITED STATES.

BY E. D. COPE.

THE principal Tertiary formations of the region between the Mississippi river and the Sierra Nevada are the following, as mainly determined by Dr. Hayden: The Puerco, the Wasatch, the Bridger, the Uinta, the White River, the Truckee, the Loup Fork and the Equus beds. Several of these are again distinctly subdivided, and in a few instances such divisions have been regarded by authors as of equal importance with those above mentioned; as, for instance, the Green River portion of the Wasatch. But the evidence of vertebrate palæontology is not as yet clearly favorable to further primary subdivision than is indicated by the above names. In the following pages I will briefly describe the character and distribution of these formations.

The general history of the succession of the Tertiary lakes of the interior of the North American continent and their deposits has been developed by the labors of various geologists, prominent among whom must be mentioned Hayden, Newberry and King. It may be synoptically stated as follows:

The Laramie Cretaceous period witnessed a great difference in the topography of the opposite sides of the Rocky Mountain range. To the east were extensive bodies of brackish and nearly fresh water, with limited ocean communication, studded with islands and bordered by forests. On the west side of the range was a broad continent, composed of mostly marine Mesozoic rocks, whose boundaries are not yet well ascertained. Towards the close of the Laramie, the bed of the great eastern sea began to emerge from the waters, and the continent of the western side of the great range descended. The relations of the two regions